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AN EPIDEMIOLOGICAL STUDY OF POLIOMYELITIS IN THE DISTRICT OF COLUMBIA

By C. C. DAUER, *Epidemiologist, Health Department, District of Columbia*

A study of the available epidemiological data on poliomyelitis in the District of Columbia for recent years has revealed certain points of interest which have seemed worth reporting. The data used in this report were taken principally from the routine epidemiological records of cases reported to the District of Columbia Health Department during the years 1925 to 1937, inclusive.

As in most large cities in the United States, poliomyelitis has been reported every year in the District of Columbia since the disease was made reportable in 1911. The incidence rate has been relatively low in most years, but at irregular intervals there has been a marked increase in the number of cases. There have been no epidemics in the District of Columbia of unusual severity or intensity. Even in 1916 the incidence rate was comparatively low (10.8 per 100,000 population including nonresident cases). The highest rate of incidence ever recorded in the District of Columbia was in 1935, when the rate was 11.4 (14.3 including nonresidents). These rates are far below the maximum rates reported for a number of cities.

TABLE 1.—*Numbers of cases and deaths, case rates and death rates per 100,000 population, and case fatality rates, for white and colored persons in the District of Columbia, 1925–37*

Year	Cases			Deaths			Case rate per 100,000 population			Death rate per 100,000 population	Case fatality rate (percent)
	Total	White	Colored	Total	White	Colored	Total	White	Colored		
1925	18	17	1	2	2	0	3.8	4.9	0.8	0.4	11.1
1926	3	2	1	1	0	1	.7	.6	.8	.2	33.3
1927	7	4	3	1	1	0	1.5	1.1	3.1	.2	14.3
1928	29	29	0	4	4	0	6.1	8.3	0	.8	14.0
1929	7	3	4	2	2	0	1.4	.9	3.0	.4	28.5
1930	11	10	1	4	4	0	2.2	2.8	.7	.8	36.3
1931	12	10	2	0	0	0	2.3	2.7	1.4	0	0
1932	31	27	4	5	4	1	5.9	7.0	2.8	.9	16.0
1933	10	9	1	3	3	0	1.8	2.5	.7	.5	30.0
1934	8	6	2	1	1	0	1.4	1.4	1.3	.2	12.5
1935	68	38	30	6	6	0	11.4	8.9	18.8	1.0	9.0
1936	6	5	1	2	1	1	1.0	1.1	.6	.3	33.3
1937	21	19	2	2	2	0	3.3	4.1	1.1	.3	9.5
Total	231	179	52	33	30	3	3.2	3.9	3.0	.43	14.3

The data used in this paper refer only to resident cases reported to the health department. Each case was seen by a medical inspector in order to confirm the diagnosis and to make an epidemiological investigation. Between 90 and 95 percent of the 231 cases recorded in the 13-year period had paralysis of varying degrees, and the remainder had at least an increase in the number of cells in the spinal fluid.

In table 1 the numbers of cases, and deaths and the fatality rates are tabulated for each year from 1925 to 1937, inclusive. The case rates indicate that the disease has been at a very low endemic level in most years, and even in the years of increased prevalence the rate of incidence was not high. The average annual rate for the period was 3.2 per 100,000 population and the median rate was 2.2. Seventy-seven percent of all the cases and 90 percent of the deaths reported were in white persons (73 percent of the population of the city is white). During the period covered by this study the case rates for the white population were usually higher than those for the colored population. However, in 1935 the incidence rate of the latter was 18.8 as compared to 8.9 for the white population.

The death rate from poliomyelitis has never been high in the District of Columbia, and this is especially true for the colored population. Only three deaths from this cause among colored residents were recorded in the period from 1925 to 1937, and none of these occurred in 1935, when the incidence rate was comparatively high among them. For the whole period covered by this study the case fatality rate was 5.7 percent for the colored cases while that for the white was 16.7 percent. The wide difference in case fatality rates is also apparent for the various age groups of white and colored cases.

TABLE 2.—*Percentage distribution of cases and deaths from poliomyelitis and case fatality rates per 100 cases by age groups, 1925–37*

Age group (years)	Percent of cases in age group			Percent of deaths in age group			Case fatality rates		
	Total	White	Colored	Total	White	Colored	Total	White	Colored
0–4	31.6	28.6	42.3	30.3	30.0	33.3	13.7	17.6	4.5
5–9	39.0	41.0	36.5	24.2	23.3	33.3	8.7	9.6	5.3
10–14	11.2	11.2	9.6	9.9	10.0	0	12.0	15.0	0
15 and over	17.3	19.1	11.6	36.4	36.6	33.3	30.0	32.0	16.6

The distribution of cases according to specific age groups has shown no unusual characteristics. (See table 2.) In the years of increased prevalence the age distribution of cases was essentially the same as that during the intervening years. The principal item of interest in table 2 is the higher percentage of cases under 5 years of age in the colored than in the white group. About one-third of the white deaths

were under 5 years of age and another third were 15 years of age and over. Case fatality rates were highest in the older age groups of white cases, i. e., 15 years and over.

In the epidemiological investigations of the cases reported, statements on the economic status of the family were recorded on 90 percent of the records. A study of these data revealed no evidence of a greater incidence of the disease in one economic group than another. Similarly, the data on sanitation of the premises where the cases resided yielded no evidence of any significant differences in the incidence of groups living in poor, fair, or good hygienic surroundings.

Few of the cases reported gave any history of contact with previous cases, and in only a few instances was there any statement regarding contact of other members of the family with outside cases. Considering the close proximity of some cases there may have been more contact than the histories revealed. One of the 231 cases, a white male 7 years of age, gave a history of having had a tonsillectomy and adenoidectomy three weeks prior to the onset of symptoms. He died 6 days after the onset; the cause of death was stated to be polioencephalitis. Five percent of the cases gave a history of upper respiratory infections or gastrointestinal disorders within a month previous to the onset of the disease.

The whole series of cases was studied from the standpoint of geographical location in the city. During the 13-year period cases occurred in every section, but there was a certain amount of concentration in various sections in different years. In order to facilitate the location of groups of cases figure 1 was prepared and the various sections will be referred to in the description given below. Case rates for these sections for certain years are tabulated in table 3.

In 1925 more than half of the cases reported (11 of the 18 cases) lived in sections 1 and 2, and in a circumscribed area in these sections. In 1927 all except 1 case occurred in sections 3, 4, 5, and 6, while sections 1 and 7 were entirely free from the disease. In 1928, cases were reported from every section of the city, but a group of 8 patients resided in section 2. In 1929 all the cases were scattered through the central part of the city in sections 3 and 4. In 1930 the cases reported were mostly residents of the eastern half of the city, and the western half remained almost free. In 1931 the few cases which were reported came from various parts of the city. Most of the poliomyelitis reported in 1932 occurred in the north-central part of the city, principally sections 2, 3, and 7. The number of cases reported in 1933 was small but distributed very much as in 1932. In 1935 the cases were concentrated in sections 3, 4, and 5, and in 1937 they were distributed about equally in the various sections of the city. There were too few cases reported in 1926, 1934, and 1936 to show any evidence of concentration.

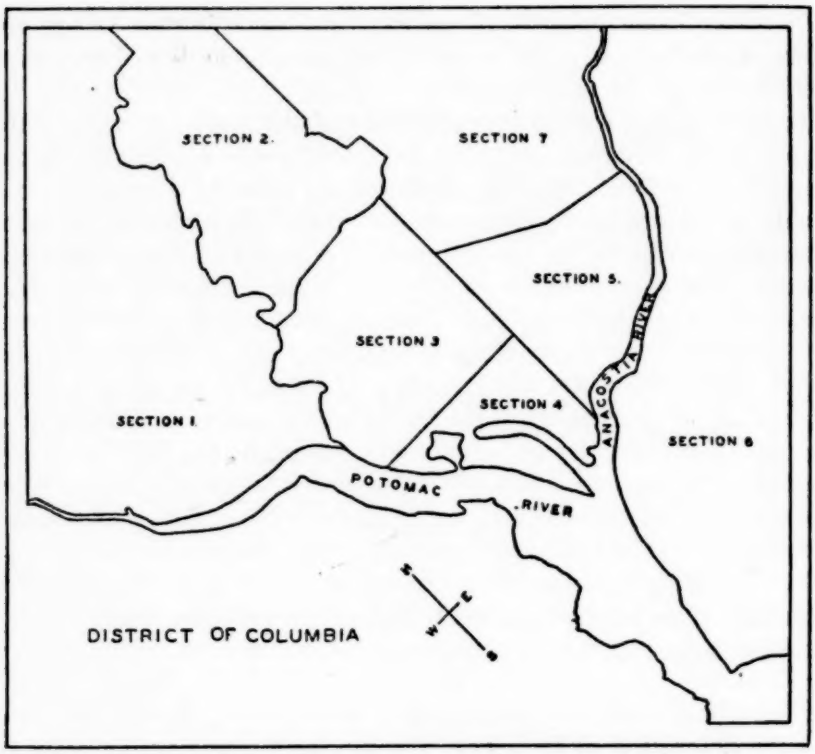

FIGURE 1.—Division of the District of Columbia into sections. See table 3 for case rates.

TABLE 3.—*Case rates per 100,000 population for white and colored persons by sections shown in figure 1*

Section No.	Estimated population 1937	Case rates per 100,000 population			
		1928	1932	1935	1925–37 [1]
	White				
1	63,319	10.0	4.0	6.3	4.4
2	102,676	11.2	11.2	8.7	5.0
3	113,374	7.7	2.0	7.0	2.8
4	15,746	0	0	6.3	3.1
5	93,254	7.0	9.6	12.8	3.8
6	[2] 18,657	5.5	0	0	3.2
7	44,821	5.7	20.0	9.0	4.4
	Colored				
1	6,316	0	0	16.0	4.6
2	7,688	0	16.6	26.0	3.8
3	95,945	0	2.6	15.6	2.8
4	15,115	0	0	13.3	1.9
5	27,745	0	4.5	32.5	5.2
6	[2] 13,736	0	0	6.0	.6
7	3,096	0	0	0	0

[1] Average annual rate.
[2] Exclusive of St. Elizabeths Hospital.

By studying in detail the geographical distribution of cases of poliomyelitis in various years it became apparent that there was a considerable amount of grouping with respect to time and place in 1928, 1932, 1935, and 1937. A more detailed description of these groups follows.

Group 1, 1928.—This group of eight cases occurred in an area located in section 2. The area involved is shown in figure 2. This area is made up almost exclusively of single homes occupied by the owners. The general character of the area is excellent, there is little crowding, and sanitation is good. The population is almost exclusively white and in moderately good economic circumstances.

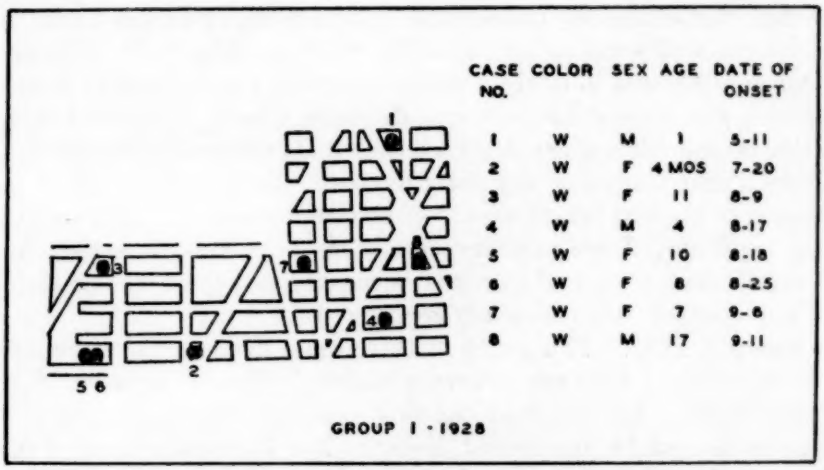

FIGURE 2.—Geographical location of cases reported in group 1, 1928, and color, sex, age, and date of onset of each case.

As indicated in figure 2, the onset of the first case reported in this area was in May, the second in July, and the remainder of the cases followed one after another at intervals of 1 to 11 days. Cases 5 and 6 were in the same family; case 6 had its onset 1 week after case 5. An aunt of these children (cases 5 and 6) who had very close contact with them while they were in the acute stages of the disease, also was in contact with another niece living in another section of the city. The latter niece had no contact with cases 5 and 6, but developed poliomyelitis; the onset was reported as being on September 14.

Five of the eight cases in this group had not been out of the city during 1 month previous to the onset of their infections, and the other three had been on very short visits to nearby summer resorts. Three families purchased milk from the same dairy, two from another dairy, one from a store, and no information was available for the remaining family. Except for case 6 there was no history of direct or indirect contact with other cases of poliomyelitis.

Group 2, 1932.—This group, which consisted of four cases, was reported from the extreme north-central part of the city, section 7. Two of these cases, both white males 3 years of age, lived in adjoining houses on the same street. The dates of onset were August 22 and 27, respectively. The other cases in this group were reported from an institution for small children. One of these children, a white male 5 years of age, became ill on September 21, and the other, a white female also 5 years of age, had her onset on September 24. There seems to have been no connection between these pairs of cases since they lived several blocks apart and because of the long interval of time between the dates of onset.

Group 3, 1932.—This group of three cases resided in the southeastern part of the city in section 5. The first reported was a case in a white male 12 years of age, with the onset on August 7. Two days later another case in a white male 19 years old was reported from an address just around the corner in the same block. The third case, a white male 3 years of age, had its onset 12 days following that of case 2. Cases 2 and 3 lived in adjoining houses. These cases occurred in a section of the city where economic conditions are at a comparatively low level and where sanitary conditions have been unsatisfactory. None of these cases had been out of the city and there was no history of any contact with previously reported cases.

Group 4, 1935.—This group of three cases lived on the same street in one block. All were colored children, 1, 3, and 8 years of age, respectively. The onset of the first case, which resided at No. 76, was on August 14; the second, living at No. 35, became ill on August 26; and the third, at No. 19, had its onset on September 24.

The street from which these cases were reported is only one block in length. The houses are all of the row, or attached, type. These dwellings have always been crowded and have proved to be very unsatisfactory and unwholesome living quarters. Flush toilets in outhouses and backyards filled with refuse have added to the generally bad sanitary state of the neighborhood.

Group 5, 1935.—This group consisted of but two cases, two adults living at the same address in section 5. The onset of the first case was on July 13 and the second was on July 18. These cases belonged to different families. The dwelling was a large residence divided into three housekeeping suites. There was no statement that there had been any contact between these cases or with any outside cases.

Group 6, 1935.—This group of cases, eight in number, resided in the eastern part of the city in section 5. The location of the cases is shown in figure 3. Some of the blocks in this area are populated exclusively by white and others exclusively by colored persons. Most of the dwellings are row houses which have been maintained in a fairly good sanitary condition.

Case 1 of the group had its onset on July 15 and case 2, who lived almost across the street, 8 days later. The onset in cases 3 and 4, living on the same side of the street in another block, occurred on August 30 and September 4, respectively. Within a period of 2 weeks the remaining cases of the group developed, cases 6 and 7 being in close proximity to cases 3 and 4.

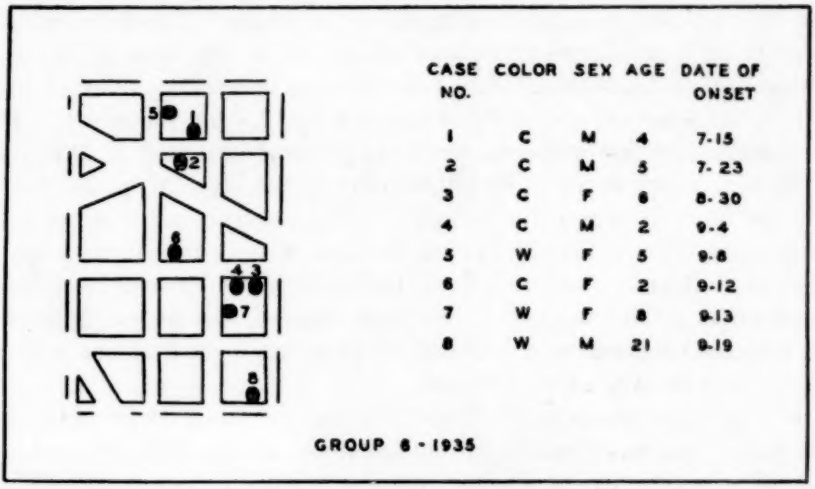

FIGURE 3.—Geographical location of cases reported in group 6, 1935, and color, sex, age, and date of onset of each case.

Only one of these cases, case 2, gave a history of having been out of the city during the month previous to the date of onset, and none gave any information regarding contact with the other cases.

Group 7, 1937.—This group consisted of three cases, all white boys, who lived on the same side of the street in one block of a fairly well-to-do section of the city in section 1. The first case, onset August 27, resided at one end of the block. The second and third cases, both in the same family and living at the other end of the block, developed the disease on September 13 and 22, respectively.

DISCUSSION

Poliomyelitis has been reported in the District of Columbia in persons living under a variety of conditions. Localized outbreaks have occurred in different areas where economic and environmental conditions have varied from good to bad.

The distribution of the disease has been very uneven from year to year, some sections having had comparatively high rates in some years and low rates of incidence in others. This unevenness in distribution has been a prominent characteristic of the disease in other localities.

The distribution of the disease according to race has shown some very curious variations in the District of Columbia. The case rates were higher in white persons in 9 out of the 13 years from 1925 to 1937. The ratio of white and colored rates for these 9 years varied from 2 to 1 to 6 to 1, except in 1928, when no colored cases were reported. In 1926, 1927, and 1929 the number of cases reported was too small to warrant comparing case rates of white and colored persons. In 1935 the colored rate was twice as high as the white. The high colored rate in 1935 was present in five of the seven sections of the city considered in this report. The rates in these five sections varied from 13.3 to 32.5 for colored persons and 6.3 to 12.8 for the white. The maximum rate for white and colored persons occurred in the same section, i. e., section 5. In all sections of the city except section 5, the incidence in the white population was essentially the same as in 1928 and 1932. It is evident that the high rate for the city as a whole in 1935 was due to a comparatively high rate of incidence in the colored population. The reason for this high colored rate is not apparent. It was not limited to a section where a large part of the colored population has been concentrated.

Poliomyelitis has occurred in certain areas of the District of Columbia in different years under circumstances which suggest some connection or association between cases occurring within these areas. When consideration is given to the dates of onset of these cases the possibility of some form of direct or indirect contact between cases, or a common source of infection, or both, is strengthened. The frequency of close proximity of cases in various areas does not seem to have occurred by chance alone. There were two instances of two cases in the same family, two cases in an institution for children, two cases in different families living in the same dwelling, and three instances of cases reported from adjoining houses. The interval between the onset of the first and second case varied from 3 to 12 days for these six pairs of cases. The dates of onset of other groups of cases living in close proximity on the same street or in the same block are equally suggestive of some close relationship.

MOTTLED ENAMEL IN SOUTH DAKOTA *

By H. Trendley Dean, *Dental Surgeon*; Elias Elvove, *Senior Chemist, National Institute of Health, United States Public Health Service*; and Richard F. Poston, *Assistant Sanitary Engineer, South Dakota State Board of Health*

Mottled enamel has been endemic in South Dakota for a number of years. As early as 1916 McKay (*1*) demonstrated by surveys its presence at Kidder, Britton, Langford, Pierpont, Andover, Groton,

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and Aberdeen. In each of these communities the endemicity was associated with the use of artesian well water obtained from the Dakota sandstone.

In 1932 (*2*) one of us (HTD), while studying selenium poisoning in South Dakota, observed endemic mottled enamel at Wolsey, Vayland, St. Lawrence, Miller, and at the Spear's School midway between Miller and Ree Heights. Evidence of mottled enamel was also noted in children living south and east of Harrold and in the rural districts north of Holabird and Highmore. A mild degree of mottled enamel was also observed in children residing on ranches in the northwest section of Lyman county and a border line degree of affection was present at Edgemont, apparently associated with the common water supply. Time did not permit detailed studies, but the development of mottled enamel in each locality was seemingly associated with the use of deep well water.

In the questionnaire study of geographical distribution of mottled enamel conducted by the United States Public Health Service and published in 1933 (*2*), questionnaires were sent to 142 selected South Dakota dentists, of whom 78 replied. Their answers pointed to numerous other localities which were listed in the 1933 report as "reported" mottled enamel areas. These places included Cavour, Yale, Iroquois, Hitchcock, Chelsea, Lake Preston, Bancroft, Fedora, Roswell, Vilas, Carthage, Esmond, the Whetstone Valley of Roberts County, Artesian, Forestburg, Doland, Conde, and Frankfort.

METHOD OF SURVEY

The present study was made by the United States Public Health Service with the active cooperation and assistance of the South Dakota State Board of Health. The planning of the itinerary was facilitated by the extensive preliminary chemical studies of common water supplies made by the division of sanitary engineering of the State board of health, in cooperation with the State chemist.

Each of the communities hereinafter referred to was visited, and subsequently with the cooperation of the local superintendent of education, school children, generally of the third to the eighth grades, inclusive, were examined. A total of 53 cities, towns, or rural communities in 21 counties was visited and 3,350 [1] school children were examined. The survey provided general information on the extent of the affected territory and an approximate index of the degree of severity of the mottled enamel being produced.

Upon visiting a classroom, the purpose of the survey was first explained and those children who stated that they had lived in the

[1] Includes 15 children examined at Harrold and 8 at Bristol but not included in tables that follow, and the 35 examined at Andover which are discussed separately in the text.

community continuously since birth and had always used the common water supply for domestic purposes (drinking and cooking) were assembled in a separate group. This group was then further questioned to determine whether there had been any breaks in the continuity of their residence and water consumption. If questioning disclosed breaks in the continuity of exposure (30 days in any calendar year excepted) the child was eliminated from this group. This group in the tables to follow is listed as "(*a*) Continuous residence". The remaining pupils in the classroom were then divided into two groups—those who had always lived in the surrounding rural district (boundaries of the school district) and shown in the tables under the heading "(*b*) Nearby rural", and those with two or more residences and water supplies and shown in the tables as "(*c*) Discontinuities". With the pupils divided into three groups, under good illumination each child was examined by one of us (HTD) and the presence or absence of mottled enamel recorded, the degree of severity being noted in accordance with a standard of classification previously described (*3*).[2]

The examination of the first group indicated the degree of endemicity associated with the use of the communal water supply; the examination of the second group showed whether or not the types of water used on the nearby farms were producing mottled enamel; while the examination of the third group, those with different residences and water histories, frequently revealed clinical mottled enamel developed either in other areas of known endemicity or in localities hitherto unreported as endemic areas.

SURVEY FINDINGS

The results of this survey are summarized as follows: Table 1 details the mottled enamel findings and history of the common water supply of 37 communities where a sufficient number of children were examined to warrant the computation of an approximate or tentative community mottled enamel index. Figure 1 shows the percentage distribution according to severity of affection of that part of the group examined who stated that they had resided continuously in the community and had always used the common water supply. In addition the percentage incidence of affection and the approximate or tentative mottled enamel index of the community is listed.

[2] This classification of diagnosis has since been abridged by combining "Moderately Severe" and "Severe" into one classification: "Severe".—HTD.

TABLE 1.—*Summary of mottled enamel findings and history of water supply in certain cities and towns of eastern South Dakota*

Town and population (Census of 1930)	Total number of children examined	Children classified according to mottled enamel diagnosis						History of water supply	Remarks
		Normal	Questionable	Very mild	Mild	Moderate	Severe		
LANGFORD (444)									
(*a*) Continuous residence	74	0	0	3	0	6	3	From 3 1¼-inch and 2 2-inch, 1,000-foot wells. In 1937 1 4½-inch, 977-foot well was added but is not in general use because of high turbidity.	All children 3d to 8th grade, inclusive, were examined.
(*b*) Nearby rural		2	2	3	8	6	2		
(*c*) Discontinuities		9	4	10	6	9	1		
HECLA (558)									
(*a*) Continuous residence	79	0	1	2	3	8	0	From 1 4-inch and 1 6-inch, 1,000-foot wells installed in 1910 and 1931, respectively.	All children 3d to 8th grade, inclusive, were examined.
(*b*) Nearby rural		2	3	3	0	4	2		
(*c*) Discontinuities		12	5	9	14	10	1		
BRITTON (1,312)									
(*a*) Continuous residence	180	2	4	11	10	26	10	From 1 3-inch and 1 8-inch, 1,000-foot wells installed in 1902 and 1933, respectively.	All children 3d to 8th grade, inclusive, were examined, plus all high school pupils with continuous exposure.
(*b*) Nearby rural and discontinuities		42	8	19	13	24	11		
RAYMOND (200)									
(*a*) Continuous residence	42	1	1	4	2	8	2	From a 4-inch 1,100-foot well installed in 1920.	Do.
(*b*) Nearby rural		3	0	1	1	2	3		
(*c*) Discontinuities		7	1	4	1	1	0		
LAKE PRESTON (944)									
(*a*) Continuous residence	81	1	1	5	18	19	6	From 2 4½-inch 1,178-foot wells installed in 1913 and 1920, respectively.	(*a*) Children continuous exposure 3d to 12th grade, inclusive, examined; (*b*) (rural) 6th, 7th, and 8th grades only; (*c*) (discontinuities) 3d, 4th, and 5th grades only.
(*b*) Nearby rural		3	1	0	0	0	0		
(*c*) Discontinuities		16	1	3	4	2	1		
CLAREMONT (285)									
(*a*) Continuous residence	49	0	1	7	3	6	1	From 1 2-inch 975-foot well drilled in 1916.	All children 4th to 8th grade, inclusive, were examined plus all high-school pupils with continuous exposure.
(*b*) Nearby rural		3	0	2	1	2	0		
(*c*) Discontinuities		4	3	5	2	9	0		
NORTHVILLE (260)									
(*a*) Continuous residence	53	1	0	1	8	4	2	From 2 2-inch 900-foot wells installed in 1920.	All children 4th to 12th grade, inclusive, were examined.
(*b*) Nearby rural		6	0	4	2	1	1		
(*c*) Discontinuities		9	3	3	6	2	0		
CONDE (431)									
(*a*) Continuous residence	48	1	2	6	3	4	2	From 1 3-inch 1,000-foot well installed in 1905.	All children 3d to 8th grade, inclusive, were examined plus all high-school pupils with continuous exposure.
(*b*) Nearby rural		0	0	0	0	0	1		
(*c*) Discontinuities		4	5	7	4	8	1		

TABLE 1.—*Summary of mottled enamel findings and history of water supply in certain cities and towns of eastern South Dakota*—Continued

Town and population (Census of 1930)	Total number of children examined	Children classified according to mottled enamel diagnosis						History of water supply	Remarks
		Normal	Questionable	Very mild	Mild	Moderate	Severe		
ST. LAWRENCE (413)									
(*a*) Continuous residence	62	5	2	6	6	9	0	From 1 2-inch 1,300-foot well installed in 1920.	All children 3d to 8th grade, inclusive, were examined, plus 1st and 2d grades and high-school pupils with continuous exposure.
(*b*) Nearby rural		4	0	0	2	1	0		
(*c*) Discontinuities		14	2	6	2	3	0		
PIERPONT (379)									
(*a*) Continuous residence	69	1	2	7	9	7	0	From 1 6-inch 1,165-foot well drilled in 1912 and from 1 6-inch 90-foot well. The shallow well furnishes only about 1 percent of the town's water.	All children 3d to 8th grade, inclusive, were examined.
(*b*) Nearby rural		6	4	2	0	3	0		
(*c*) Discontinuities		15	3	4	2	4	0		
WOLSEY (455)									
(*a*) Continuous residence	90	1	3	2	6	4	0	From 1 4-inch 980-foot well installed in 1920.	All children 3d to 12th grade, inclusive, with continuous exposure in Wolsey or rural district were examined. (*c*) Includes children from 3d to 8th grades only.
(*b*) Nearby rural		37	3	3	1	1	0		
(*c*) Discontinuities		20	0	4	5	0	0		
PLATTE (1,207)									
(*a*) Continuous residence	75	9	10	12	12	10	2	From 2 wells, 1 6-inch 465-foot installed in 1914 and from an 8-inch 859-foot well installed in 1936. A 6-inch 465-foot well constructed in 1924 was abandoned in 1926 and an 8-inch 290-foot well drilled in 1926 was abandoned in 1936.	All children 3d to 12th grade, inclusive, with continuous residence were examined.
(*b*) Discontinuities		14	3	2	1	0	0		
HITCHCOCK (334)									
(*a*) Continuous residence	40	2	2	5	2	3	0	Between 1910 and 1937 from a 3-inch, 900-foot well. Since 1937 from a 1½-inch, 1,040-foot well.	All children 4th to 8th grade, inclusive, examined.
(*b*) Nearby rural		8	1	0	0	0	0		
(*c*) Discontinuities		9	2	3	2	1	0		
REDFIELD (2664)									
(*a*) Continuous residence	117	14	5	14	5	9	1	From 4 wells; 2 4½-inch drilled in 1906 and 1911, respectively; 1 6-inch drilled in 1917 and 1 8-inch drilled in 1920. A 3-inch well drilled in 1908 and a 6-inch well drilled in 1914 were abandoned in 1933. All wells approximately 1,000 feet deep.	All children of the 4th, 5th, and 6th grades were examined.
(*b*) Discontinuities		48	3	12	2	4	0		
IROQUOIS (531)									
(*a*) Continuous residence	99	8	2	8	5	4	1	Present supply obtained from 2 6-inch, 900-foot wells installed in 1900 and 1923. Between 1908 and 1937 the supply was augmented with water from a 2½-inch 900-foot well, now abandoned.	All children 4th to 12th grade, inclusive, were examined.
(*b*) Nearby rural		8	0	4	3	2	0		
(*c*) Discontinuities		30	5	10	7	2	0		

TABLE 1.—*Summary of mottled enamel findings and history of water supply in certain cities and towns of eastern South Dakota*—Continued

Town and population (Census of 1930)	Total number of children examined	Children classified according to mottled enamel diagnosis						History of water supply	Remarks
		Normal	Questionable	Very mild	Mild	Moderate	Severe		
DOLAND (538)									
(a) Continuous residence	54	5	4	2	10	4	0	From 1 6-inch and 1 3-inch well drilled in 1925 and 1935, respectively. Both wells approximately 1,000 feet deep.	All children 3d to 8th grade, inclusive, were examined.
(b) Nearby rural		3	3	1	1	1	0		
(c) Discontinuities		3	3	7	3	4	0		
MELETTE (383)									
(a) Continuous residence	42	5	4	4	6	2	1	From 2 2-inch, 930-foot wells installed in 1910.	All children 4th to 8th grade, inclusive, were examined, plus all high-school pupils with continuous exposure.
(b) Discontinuities		8	3	4	3	1	1		
IPSWICH (913)									
(a) Continuous residence	99	11	9	15	12	5	1	From 3 2-inch wells, 1,200 feet, 1,470 feet, and 1,540 feet deep, respectively. Date of installation unknown.	All children 3d to 12th grade with continuous exposure examined; in addition, rural children, 3d to 6th grade and broken histories, 3d to 8th grade.
(b) Nearby rural		6	0	1	1	0	0		
(c) Discontinuities		21	5	7	5	0	0		
GETTYSBURG (1,400)									
(a) Continuous residence	151	17	7	16	8	3	2	From 1 1½-inch, 2,130-foot well drilled in 1900 and from a 4-inch, 1,920-foot well installed in 1922.	All children 3d to 8th grade with continuous exposure examined. Rural and broken histories from 4th to 8th grade, inclusive.
(b) Nearby rural		15	1	2	0	0	0		
(c) Discontinuities		70	3	1	5	1	0		
FAULKTON (739)									
(a) Continuous residence	96	15	5	24	7	5	0	From a 3-inch, 1,400-foot well drilled in 1922. Prior 1922 from a well similar in diameter and depth abandoned in 1926.	All children 3d to 8th grade, inclusive, were examined.
(b) Nearby rural		2	0	0	0	0	0		
(c) Discontinuities		23	2	6	3	4	0		
MILLER (1,447)									
(a) Continuous residence	105	17	9	15	7	3	0	From a 1,650-foot, 6-inch well installed in 1926. Prior to that time from 3 4-inch, 1,650-foot wells directly connected to the mains. These wells are at present connected with the mains but due to lowered artesian pressure furnish but a small amount of water. Six-inch well is pumped.	All children 4th to 7th grade examined, plus 8th grade pupils with continuous exposure.
(b) Nearby rural		6	0	0	1	0	0		
(c) Discontinuities		29	2	11	2	3	0		
CARTHAGE (590)									
(a) Continuous residence	77	9	7	8	8	2	0	From 1 4-inch, 1,100-foot well installed in 1908.	All children 3d to 8th grade examined, plus high school pupils with continuous exposure.
(b) Nearby rural		2	0	0	3	0	0		
(c) Discontinuities		12	3	9	5	8	1		
FEDORA (225)									
(a) Continuous residence	67	8	2	4	2	1	0	Communal supply. Town is supplied by groups of individuals sharing the expense of drilling and piping flowing artesian wells. Wells are all 1 inch or 1¼ inches in diameter and are approximately 700 feet deep.	All children examined, 4th to 8th grade, inclusive, plus high school pupils of continuous exposure in both Fedora and surrounding rural districts.
(b) Nearby rural		9	9	8	3	4	0		
(c) Discontinuities		5	4	7	1	0	0		

TABLE 1.—*Summary of mottled enamel findings and history of water supply in certain cities and towns of eastern South Dakota*—Continued

Town and population (Census of 1930)	Total number of children examined	Children classified according to mottled enamel diagnosis						History of water supply	Remarks
		Normal	Questionable	Very mild	Mild	Moderate	Severe		
KIMBALL (111)									
(*a*) Continuous reisdence	58	24	4	6	5	1	1	From 1 4½-inch, 1,300-foot well installed in 1915.	All children of continuous exposure 4th to 12th grade, examined. Broken-history group from 7th grade only.
(*b*) Discontinuities		14	2	1	0	0	0		
ABERDEEN (16,465)									
(*a*) Continuous residence	166	109	20	24	10	3	0	At present from impounded surface (river) supply installed in 1935. Previously from 4 6-inch and 2 8-inch wells. Water from 3 of the wells emptied into covered reservoir southeast section of city; water from 2 wells emptied into open reservoir in northwest part of city: water from each reservoir pumped directly into distribution system. Water from sixth well pumped directly into distribution system. In addition there are reports of other artesian wells (number unknown) connected directly to the distribution system. Wells approximately 1,200 feet deep.	All children of continuous exposure in 4th, 5th, and 6th grades of 3 schools plus pupils of 7th and 8th grades of 1 school examined.
TULARE (305)									
(*a*) Continuous residence	44	2	1	4	3	0	0	From 1 3-inch 1,200-foot well installed in 1916.	All children 4th to 8th grade, inclusive, examined.
(*b*) Nearby rural		8	2	1	1	1	0		
(*c*) Discontinuities		15	3	3	0	0	0		
LEOLA (724)									
(*a*) Continuous residence	103	9	6	10	6	0	0	From 1 4-inch 1,600-foot well installed in 1930. Prior to that year from a 1-inch 1,636-foot well installed in 1911 and abandoned in 1930.	Do.
(*b*) Nearby rural		19	1	1	0	1	0		
(*c*) Discontinuities		37	6	6	1	0	0		
ONIDA (636)									
(*a*) Continuous residence	75	17	3	6	5	0	0	From 2 wells. One 2½-inch 1,640-foot installed in 1911 and 1 6-inch 1,700-foot well put in in 1933.	All children 3d to 8th grade, inclusive, examined.
(*b*) Nearby rural		11	0	6	0	1	0		
(*c*) Discontinuities		25	1	5	1	0	0		
FRANKFORT (367)									
(*a*) Continuous residence	59	9	5	3	2	0	0	From 2 2-inch 1,000-foot wells installed in 1926 and from 1 3-inch 1,020-foot well drilled in 1929.	Do.
(*b*) Nearby rural		2	3	6	1	1	0		
(*c*) Discontinuities		17	2	1	6	1	0		
GROTON (1,009)									
(*a*) Continuous residence	104	11	5	13	2	0	0	From 2 wells, a 4-inch 900-foot well installed in 1927, owned by the city, and a 6-inch 900-foot well owned by C. M. St. P. and P. R. R. Most of common water supply from city well.	All children 4th to 8th grade, inclusive, examined.
(*b*) Nearby rural		4	2	2	4	0	1		
(*c*) Discontinuities		28	5	11	7	6	3		

TABLE 1.—*Summary of mottled enamel findings and history of water supply in certain cities and towns of eastern South Dakota*—Continued

Town and population (Census of 1930)	Total number of children examined	Children classified according to mottled enamel diagnosis						History of water supply	Remarks
		Normal	Questionable	Very mild	Mild	Moderate	Severe		
HOWARD (1,224)									
(a) Continuous residence	111	31	8	6	3	0	0	From 2 8-inch 405-foot wells drilled in 1900 and 1910 and still in use.	All children 4th to 8th grade, inclusive, examined, plus high-school pupils of constant exposure.
(b) Nearby rural		8	0	0	1	0	0		
(c) Discontinuities		38	5	9	0	2	0		
ASHTON (314)									
(a) Continuous residence	38	8	1	8	1	0	0	From 2 2-inch 1,100-foot wells installed in 1915 and 1929, respectively.	All children 3d to 8th grade, inclusive, examined.
(b) Nearby rural		0	0	1	1	0	0		
(c) Discontinuities		9	3	4	2	0	0		
CAVOUR (202)									
(a) Continuous residence	78	13	5	4	0	0	0	From 1 2-inch 850-foot well drilled in 1924. Prior that date from a well of same depth abandoned in 1926.	All children 1st to 12th grade, inclusive, examined.
(b) Nearby rural		20	2	3	1	1	0		
(c) Discontinuities		19	4	2	1	3	0		
ARLINGTON (1,020)									
(a) Continuous residence	47	40	6	1	0	0	0	From 2 wells, 2½ inches and 4 inches in diameter, 1,320 feet deep and installed in 1915 and 1930, respectively. 1915 well used for reserve purposes since 1930.	All children 4th to 12th grade of continuous exposure examined.
DE SMET (1,017)									
(a) Continuous residence	75	25	2	0	0	0	0	From a 42-foot gravel packed "Kelly Well" installed in 1927. Prior that date from a shallow well of same depth.	All children of constant residence, 4th to 12th grade, city and rural, examined. Broken histories from 8th grade only
(b) Nearby rural		26	0	1	0	2	0		
(c) Discontinuities		14	3	2	0	0	0		
ALPENA (499)									
(a) Continuous residence	58	13	0	0	0	0	0	From 1 20-foot dug well 12 feet in diameter installed in 1920 and now used for reserve, and 2 4-inch flowing artesian wells, one 887 feet deep, installed in 1927, and one 784 feet deep, installed in 1935.	All children 3d to 8th grade, inclusive, examined.
(b) Nearby rural		16	1	0	0	0	0		
(c) Discontinuities		22	4	2	0	0	0		
WESSINGTON (681)									
(a) Continuous residence	76	21	0	0	0	0	0	Present supply from gravel packed 32-foot shallow well installed in 1936. Prior to 1936 from 2 30-foot dug wells put in in 1920 and 1928 and from 1 2¼-inch 1,100-foot drilled well installed in 1903.	Do.
(b) Nearby rural		16	0	0	0	0	0		
(c) Discontinuities		33	3	2	1	0	0		
Total	2,941								

In some instances the fluoride (F) content of the common water supply at the time of the clinical examination is also given. Extreme caution, however, should be followed in correlating many of these chemical findings with the clinical observations. Because of inadequateness of the sample in certain communities or the frequency with which new wells were added or old ones abandoned during the life-

time of those examined, certain of these communities lack the requisites for a quantitative evaluation (4).[3]

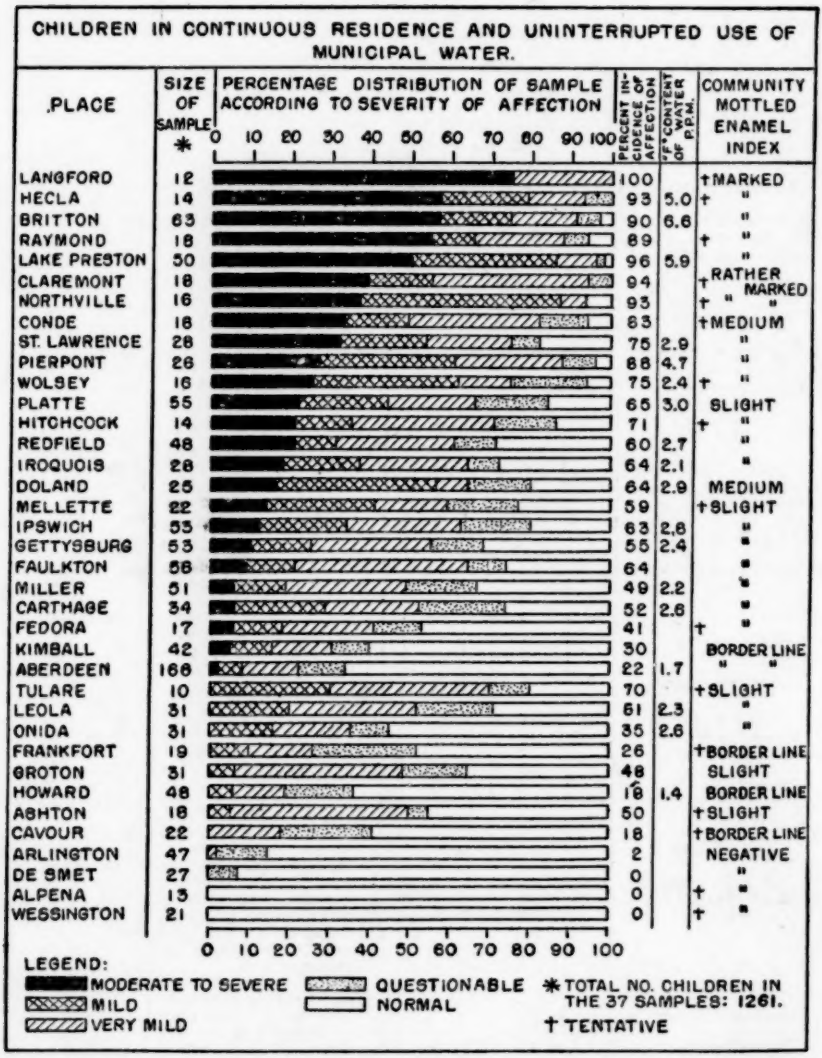

FIGURE 1.—Severity of mottled enamel in children of certain selected communities of eastern South Dakota.

[3] Lake Preston and Pierpont seemingly warrant further comment, each community having the requisites for quantitative evaluation. But if the degree of clinical severity is compared with areas studied in other States (Pub. Health Rep., 52: 1249–1264 (September 10, 1937)) one would get the impression that the degree of clinical severity is less than that commonly associated with a domestic water containing fluoride (F) in the concentration found at these places. Thus Lake Preston showed a fluoride concentration of 5.9 p. p. m., but the degree of clinical severity was not appreciably greater than that found in communities in other States where the fluoride concentration was in the neighborhood of 4.0 p. p. m. Whether or not this phenomenon is due to a lessened water intake because of meteorological conditions (long severe winters) or whether the rather unusual mineral concentration of these waters influences to some extent the activity of the fluorine, would, of course, require further investigation. It is to be remembered, also, that in many of the other areas with which comparisons are made, the figure for fluoride concentration is based on an arithmetical mean of twelve consecutive monthly samples. In the case of these South Dakota communities, the figure of the fluoride concentration is based upon a single determination.

In table 2 is listed the summary of mottled enamel findings in certain communities having a common water supply but where an insufficient number of children were examined to permit the computation of even a tentative community mottled enamel index. Table 3 summarizes the findings in six communities, four of which have no common water supply and two where the mineral composition of the common water supply is such that the water is not used for domestic purposes.

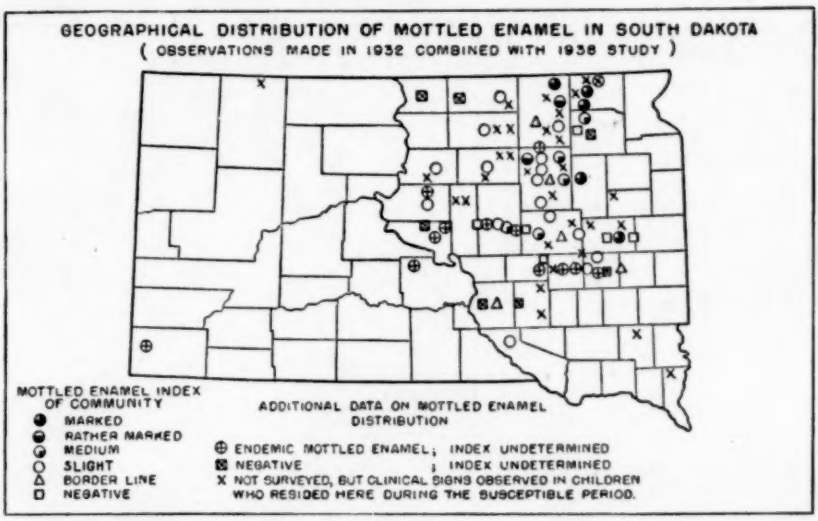

FIGURE 2.

The geographical distribution of mottled enamel is shown in figure 2, the indexes being computed upon the basis of the percentage distribution of clinical severity in the manner previously cited (*3*).

Clinical evidence suggestive of other endemic areas.—During the examinations in the school, numerous children were examined who had lived in two or more places. In tables 1, 2, and 3 such children are listed under the heading "(c) Discontinuities". In this group were many children who presented clinical evidence of mottled enamel. Cross questioning often revealed residence during the susceptible period in a known endemic area. There were, however, other children showing clinical signs of mottled enamel, who stated that they had resided during the susceptible period in areas not as yet surveyed. The actual observation of clinical mottled enamel from

TABLE 2.—*Summary of mottled enamel findings in certain communities of eastern South Dakota with a common water supply, but where an insufficient number of examinations precluded the computation of a mottled enamel index*

Town and population (Census of 1930)	Total number of children examined	Children classified according to mottled enamel diagnosis						History of water supply	Remarks
		Normal	Questionable	Very mild	Mild	Moderate	Severe		
AGAR (200)									
(*a*) Continuous residence	23	3	0	0	2	0	0	From a 4-inch 1,800-foot well installed in 1926.	All children 4th to 8th grade, inclusive, examined.
(*b*) Nearby rural		6	0	1	0	0	0		
(*c*) Discontinuities		6	3	2	0	0	0		
BRENTFORD (174)									
(*a*) Continuous residence	42	1	1	1	1	0	0	From a 3-inch 1,200-foot well drilled in 1917.	All children 4th to 8th grade, inclusive, examined. A mottled enamel of moderate severity is being developed in immediate rural district.
(*b*) Nearby rural		1	2	3	8	6	1		
(*c*) Discontinuities		5	1	3	2	6	0		
FORESTBURG (300)									
(*a*) Continuous residence	41	5	0	0	0	0	0	From a 3-inch 740-foot well installed in 1915.	All children 4th to 8th grade and 10th grade examined. Mottled enamel being developed in immediate rural district.
(*b*) Nearby rural		10	1	0	3	0	0		
(*c*) Discontinuities		15	1	3	0	3	0		
LANE (187)									
(*a*) Town and rural (continuous)	27	20	1	6	0	0	0	From a 1¼-inch 780-foot well drilled in 1928 and continuous use since.	All children 3d to 12th grade of continuous residence examined. Mottled enamel mostly from rural district.
PUKWANA (307)									
(*a*) Continuous residence	3	2	1	0	0	0	0	From 2 900-foot wells 6-inch and 3-inch installed in 1910 and 1916, respectively. Wells were recased to 3-inch and 2-inch, respectively, in 1933.	Only 3 children 1st to 8th grade have continuously used city water. Others use individual wells or cisterns.
ROSWELL (116)									
(*a*) Continuous residence	16	3	2	0	0	0	0	From a 2-inch 611-foot well installed in 1912.	All children in school examined. One "moderate" case reports using water from a 380-foot well.
(*b*) Nearby rural		6	0	0	0	1	0		
(*c*) Discontinuities		2	2	0	0	0	0		
WHITE LAKE (530)									
(*a*) Continuous residence	24	2	0	0	0	0	0	From a 4½-inch 907-foot well drilled in 1923.	5th and 6th grades examined; town has a common water supply, but residents use mostly cistern water.
(*b*) Discontinuities		19	2	1	0	0	0		
Total	176	---	---	---	---	---	---		

TABLE 3.—*Summary of mottled enamel findings in certain communities of eastern South Dakota having no common water supply and 2 places where the common water supply is not used.*

Town and population (Census of 1930)	Total number of children examined	Children classified according to mottled enamel diagnosis						History of water supply	Remarks
		Normal	Questionable	Very mild	Mild	Moderate	Severe		
ARTESIAN (556)									
(*a*) Town and rural (continuous).	51	12	5	6	3	4	0	City has a 4-inch 700-foot well installed in 1905 which with a number of individual wells are connected to a common distribution system.	All children 3d to 8th grades examined.
(*b*) Discontinuities		13	4	1	3	0	0		
EUREKA (1,308)									
(*a*) Town and rural (continuous).	35	17	1	0	0	0	0	From a 3-inch 2,300-foot well installed in 1919. For domestic purposes residents use cistern and shallow well water almost exclusively.	All of 4th grade examined. In addition all of 5th and 6th grade were questioned and no child found who used city water continuously.
(*b*) Discontinuities		16	1	0	0	0	0		
HERREID (544)									
(*a*) Town (continuous)	62	25	2	0	0	0	0	No common water supply. Residents obtain domestic water from 12-15-foot dug wells and cisterns.	All children 3d to 6th grades, inclusive, examined.
(*b*) Rural (continuous)		5	0	0	0	0	0		
(*c*) Discontinuities		29	1	0	0	0	0		
VAYLAND (550)									
(*a*) Town and rural (continuous).	19	5	2	2	0	0	0	No common water supply.	All children 1st to 8th grades examined.
(*b*) Discontinuities		8	1	1	0	0	0		
VILAS (106)									
All pupils present	8	7	1	0	0	0	0	No common water supply.	Enrollment of school: 9.
WOONSOCKET (1,108)[1]									
Total	175								

[1] Due to extreme hardness and magnesium sulfate content of city water, common water supply little used for domestic purposes. A few children in 3d and 4th grades stated they had used the common water supply but it was not possible to find a single pupil in the 5-8 grades who had used city water continuously. Local superintendent of education states there are approximately 300 individual wells in the community. Mottled enamel observed in children using water from artesian wells in this locality.

these places warrants their listing as "probable" endemic areas pending confirmation by surveys. These places are:

County	*Towns or Rural Districts*
Aurora	Stickney and northern part of county.
Beadle	Yale, Virgil.
Brown	Putney, Ferney, Bath, and rural districts north of Aberdeen.
Edmunds	Craven, Mina.
Faulk	Chelsea, Cresbard, Orient.
Hamlin	Hazel.
Kingsbury	Bancroft, Hetland.
Marshall	Newark, Amherst.
McPherson	Wetonka.
Perkins	Lemmon.
Potter	Gorman.
Sanborn	Northeast and western section of county.
Spink	Athol, Crandon, Turton.
Turner	Parker.
Union-Lincoln	Beresford.[4]

As has been previously noted, endemic mottled enamel has also been observed in children residing in the rural districts north of Holabird and Highmore.

Effects following the change of water supply at Andover, South Dakota.—The previously mentioned survey by McKay in 1916 (*1*) disclosed endemic mottled enamel at Andover associated with the use of the town artesian well water. In 1928 this community changed its common water supply from the 800-foot artesian well to a dug shallow well 22 feet deep. There is a local record that the supply from the 800-foot artesian well was augmented between 1926 and 1928 by a small amount of water from a 170-foot well. Both the 800-foot well and the 170-foot well were abandoned in 1928, and since that date the common water supply of Andover has been obtained wholly from the dug shallow well.

This survey revealed the marked clinical difference resulting from the change in the common water supply. In the Andover school were 35 children who stated that they were born in Andover, had resided there continuously, and had always used the common water supply. Fourteen of this group were between 7 and 10 years of age, a group that obviously used the shallow well water exclusively for domestic purposes. None of the 14 showed evidence of mottled enamel. In the intermediate group there were 8 children, ages 11 to 13, who had calcified their permanent teeth while using both water supplies, and 3 of the 8, or 37 percent, showed mottled enamel; and in the highest age group, 14 to 18, there were 13 children who apparently calcified their teeth while using the artesian water, and 9 of these, or 69 percent,

[4] A recent survey by Dr. R. H. Wilcox, epidemiologist, State Board of Health, has demonstrated endemic mottled enamel at Beresford.

showed mottled enamel. These differences are presented in tabular form in the following table:

TABLE 4.—*Clinical differences following a change in the common water supply at Andover, S. Dak.*

Age at time of examination	18–14	13–11	10–7
Water used during period of tooth calcification.	Deep well (artesian)	Both supplies	Dug shallow well.
Number of children examined	13	8	14.
Percentage with mottled enamel	69	37	0.

Water supplies.—Endemic mottled enamel in South Dakota seems limited to the users of artesian water obtained from the Dakota sandstone. For a complete description of this aquifer the reader is referred to the work of Darton (Water Supply Paper No. 227, United States Geological Survey, and earlier publications). Data respecting the common water supplies referred to in the tables under the heading "History of Water Supplies" were obtained by one of the authors (RFP).

During the survey, samples of the present common water supply of 18 communities and 2 samples of the "old" Aberdeen supply were collected for chemical analyses. The mineral composition of the samp'es, Aberdeen excepted, indicated merely the type of domestic water used at the time of the survey; it must be remembered that the clinical effects noted at the same time reflect the type of water used 8 to 15 years previously, dependent upon the age group examined. Reference to the data recorded in the tables under "History of Water Supplies" will reveal whether or not a correlation of the fluoride (F) content of the water with the clinical condition observed is warranted.

The fluoride content was estimated colorimetrically by means of the zirconium-alizarin reagent (*5*). In accordance with our usual custom, constituents of the water, other than fluoride, were likewise determined. These analyses are shown in table 5.

DISCUSSION

On the basis of studies to date endemic mottled enamel in South Dakota seems limited solely to users of artesian water obtained from the Dakota sandstone. Fortunately none of the larger cities in eastern South Dakota (Sioux Falls, Aberdeen, Huron, Watertown, or Mitchell) obtain their common water supplies from this aquifer [5] and the endemicity is limited to the smaller communities and rural districts.

Chronic endemic dental fluorosis (mottled enamel) is widely distributed in South Dakota. The known endemic and "probable" areas with few exceptions are in that part of the State lying east of

[5] Aberdeen changed to a surface supply in 1935.

TABLE 5.—*Analyses of selected South Dakota common water supplies* *

No.	City or town	Residue on evaporation	Loss on ignition	Fixed residue	Silica (SiO_2)	Iron (Fe)	Aluminum (Al)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (calculated as Na)	Carbonate (CO_3)	Bicarbonate (HCO_3)	Sulphate (SO_4)	Nitrate (NO_3)	Chloride (Cl)	Phosphate (PO_4)	Boron (B)	Fluoride (F)	No.
		Parts per million (p. p. m.)																	
1	Hecla	3,000	28	2,972	12.0	0.12	0.5	54.3	5.2	965.5	0	311.1	1,407.9	5.3	375.0	0	2.4	5.0	1
2	Britton	2,568	26	2,542	23.2	.10	.3	25.7	3.5	870.4	0	341.6	1,132.0	4.4	333.0	0	2.8	6.6	2
3	Lake Preston	2,193	23	2,170	11.6	.14	.1	14.3	4.8	746.0	8.4	409.9	940.0	9.7	191.5	.1	3.5	5.9	3
4	St. Lawrence	2,134	94	2,040	13.2	.14	.2	132.2	38.4	494.5	0	192.7	1,113.2	9.7	153.0	0	1.1	2.9	4
5	Pierpont	2,459	22	2,437	12.8	.08	.6	14.3	5.2	827.6	0	453.8	1,057.6	8.8	235.5	.5	2.6	4.7	5
6	Wolsey	2,132	90	2,042	12.8	.17	.6	140.0	32.8	485.7	0	170.8	1,114.0	9.7	154.0	0	1.1	2.4	6
7	Platte	1,894	33	1,861	9.6	.18	.3	22.9	8.7	655.8	0	534.3	255.1	7.9	601.5	0	3.2	3.0	7
8	Redfield	2,260	62	2,198	22.0	.10	.5	40.0	4.4	722.7	0	261.0	1,117.4	8.8	209.0	0	2.1	2.7	8
9	Iroquois	2,116	16	2,100	15.2	.18	.3	11.4	3.5	704.6	0	301.3	1,069.6	8.4	156.0	0	1.6	2.1	9
10	Doland	2,276	21	2,255	12.8	.08	.3	17.2	.9	787.5	36.0	268.4	941.2	6.2	333.0	0	1.5	2.9	10
11	Ipswich	2,192	198	1,994	18.4	.15	.3	323.0	65.5	211.1	0	191.5	1,234.2	4.0	67.0	0	.2	2.8	11
12	Gettysburg	2,062	14	2,048	22.4	.10	.1	14.3	.9	768.0	0	744.2	355.5	8.8	499.5	.1	3.0	2.4	12
13	Miller	2,152	114	2,038	16.4	.08	.2	185.8	52.4	394.9	0	178.1	1,178.7	7.0	107.0	0	1.2	2.2	13
14	Carthage	2,143	40	2,103	10.0	.08	.2	41.4	15.3	654.6	0	235.4	1,035.9	11.0	218.5	0	1.1	2.6	14
15	Aberdeen (West Hill) [1]	2,145	148	1,997	10.4	.06	.6	240.0	53.3	325.7	0	170.8	1,222.6	14.0	67.0	0	.4	1.8	15
16	Aberdeen (Washington St.) [1]	2,183	169	2,014	16.8	.07	.6	217.2	34.1	388.6	0	175.6	1,234.2	14.4	76.0	0	.4	1.6	16
17	Leola	2,228	36	2,192	11.2	.06	.3	34.3	3.5	814.0	32.4	827.1	312.6	7.9	560.0	0	3.8	2.3	17
18	Onida	1,988	72	1,916	16.0	.06	.6	111.5	9.6	522.6	0	195.2	949.4	9.7	218.5	.1	1.4	2.6	18
19	Howard	2,176	132	2,044	28.0	.08	.1	215.5	57.7	372.9	0	317.2	1,147.0	8.8	71.0	0	1.0	1.4	19
20	Andover	1,726	272	1,454	34.4	.07	.3	217.3	94.3	134.7	0	424.5	829.4	4.0	16.0	0	0	0	20

* Water samples were collected during the survey, in April and May 1938.

[1] Samples from wells of the "old" supply; a "new" impounded surface water supply was installed in 1935.

NOTE.—Assistant Chemist C. G. Remsburg carried out the determinations other than flouride and boron, using mostly the methods given in the Standard Methods of Water Analysis of the American Public Health Association. The phosphate was determined colorimetrically by an adaptation of the Benedict and Theis Method (J. Biol. Chem., 61: 63 (1924)). The boron determinations were made essentially by the method of Foote (J. Ind. Eng. Chem., Anal. Ed., 4: 39 (Jan. 15, 1932)).

the Missouri River; together they embrace a total of 26 counties. Briefly, the data presented in the distribution map shows that endemic mottled enamel has been demonstrated in 41 communities divided among 20 counties. In addition, a "border-line" degree of endemicity was observed in 5 communities. Furthermore, there are 30 other places listed as "probable" endemic areas on the basis of observed clinical mottled enamel in children who resided in these places during the period of susceptibility. Thirteen other communities either included in this survey or subject to observations made in 1932 are listed as "negative."

Although the Andover studies were only incidental to the main investigation, the facts disclosed deserve further attention. This community represents the third recorded instance of mottled enamel being prevented simply by changing the water supply from one containing comparatively high concentrations of fluorides to one that is free, or nearly free, from fluorides. The difficulty of obtaining evidence of this nature in a human population is evident when it is realized that a lapse of 8 to 10 years is required after the change in the water supply before the clinical consequence is demonstrable. The various aspects of the evidence of clinical differences, together with the report of the results noted in two other communities, Oakley, Idaho, and Bauxite, Arkansas, have been discussed in detail in another paper (*6*).

SUMMARY

1. There are 41 communities in South Dakota divided among 20 counties where endemic mottled enamel has been demonstrated by survey.

2. In addition there are 30 other places where mottled enamel is probably endemic.

3. The endemicity is seemingly limited to the smaller communities and rural districts where the inhabitants obtain their domestic water from the Dakota sandstone.

ACKNOWLEDGEMENT

The authors are greatly indebted to State Sanitary Engineer W. W. Towne for his assistance in planning the study and providing much preliminary information on the fluorine content of numerous South Dakota public water supplies. This basic information permitted the outlining of an itinerary that resulted in considerably enlarging the region of known endemicity in South Dakota.

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THE EFFECT OF ARTIFICIAL TEMPERATURES ON STABILITY OF NEOARSPHENAMINE

By T. F. Probey, *Associate Pharmacologist*, and W. T. Harrison, *Senior Surgeon, United States Public Health Service*

The regulations for the control of arsphenamine and its derivatives prior to 1938 (*1*) required that the stability of these preparations should be determined by exposing the ampuled product to a temperature of 56° C. for 24 hours, during which time it should show no marked change in color, consistency, or solubility. Similar tests are required by the United States Pharmacopoeia, XI (*2*), and are also included in the control regulations of certain other countries. Since the adoption of this test all of the arsphenamine products received for official examination have been tested routinely for stability. Roth (*3*), in 1921, reported that temperature is an important factor in hastening the deterioration of some lots of neoarsphenamine. His investigation included temperatures of 37° C. and 100° C. as well as the control at 20° C. Some lots were affected by exposure for 9 months at 37° C., while at 100° C. changes were noted after 20 minutes in 3 of 6 lots examined.

The simultaneous influence of time and temperature upon the stability of neoarsphenamine in ampule was reported by van den Branden and Dumont (*4*), in 1933. In a series of tests with the temperature range from 30° C. to 70° C. they reported no change after 34 days' exposure to 30° C., but as the temperature was increased deterioration became progressively more marked.

Stability of the arsphenamines, especially neoarsphenamine, in the presence of temperatures higher than average room temperature has been investigated to determine proper storage conditions and, also, to ascertain the influence of tropical or semitropical temperatures. The use of artificial heat as a means of determining stability, and to develop a test to estimate the keeping quality of these drugs, apparently has not been accomplished. This "heat test" at 56° C. has been performed routinely at the National Institute of Health and by the arsphenamine manufacturers, but very little was known of the

relation between the results of these tests and the actual deterioration which took place after distribution of the products.

Investigations of the stability of neoarsphenamine have indicated a number of factors which influence its keeping qualities. Roth (*3*), and van den Branden and Dumont (*4*) have demonstrated that stability varies directly with the increase in temperature and with age. Probey and Harrison (*5*) demonstrated that age and moisture content of neoarsphenamine are both factors influencing the stability of the drug, removal of moisture greatly increasing the period during which the product retains its color and solubility.

TABLE 1.—*Stability of neoarsphenamine at 56° C. Total lots, 1,353. Moisture content up to 7.0 percent. Tested January 1932 to March 1937*

	Days of exposure														Total number lots tested
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Daily samples stable	1	4	15	371	292	155	311	64	27	39	19	6	7	12	1,323
Daily samples unstable	0	0	0	3	2	3	11	5	3	2	1	0	0	0	30
Total	1	4	15	374	294	158	322	69	30	41	20	6	7	12	1,353

During the period from January 1932 to March 1937 the "heat test" was applied to 1,353 different lots of neoarsphenamine, representing all brands holding American license. The exposure time varied from 1 to 14 days at the then required temperature of 56° C. The results of these tests are presented in table 1, covering 1,323 stable lots and 30 unstable lots, instability being first noted after 4 days' exposure. Subsequently, 439 of these lots of neoarsphenamine from the reserve file of the National Institute of Health for the period 1932 to 1937 were included in investigations of the effect of moisture and age on stability. It was found (table 2) that 15 percent of 1-year-old

TABLE 2.—*The effect of age and moisture on the stability of neoarsphenamine stored at lower than average room temperature*

Moisture content, percent	Age, in years, from official release											
	5		4		3		2		1		1-5	
	Lots		Lots		Lots		Lots		Lots		Lots	
	S	U	S	U	S	U	S	U	S	U	S	U
0.0 to 1.5	21	14	13	9	24	2	34	0	37	0	129	25
1.5 to 7.0	17	38	19	39	23	36	26	32	41	14	126	159
Total number	38	52	32	48	47	38	60	32	78	14	255	184
Percent	42	58	40	60	55	45	65	35	85	15	58.1	41.9

S=stable; U=unstable.

material showed evidence of deterioration. As the age increased, instability increased to 58 percent of 5-year-old lots; and of the total lots examined for the entire period, 42 percent showed deterioration. It is evident, therefore, that the "heat test" at 56° C. for 24 hours, or even for 48 hours, is valueless as a test to predetermine the stability of neoarsphenamine.

In the effort to adjust the "heat test" to be of value in measuring stability of neoarsphenamine it becomes apparent that a temperature of 56° C. would require an exposure time greatly in excess of the observation time for the toxicity tests, and so in order to shorten the time factor the temperature was raised to 70° C. The necessity for this adjustment became apparent, as the moisture content of neoarsphenamine was reduced and stability increased.

The "heat tests" were conducted at 56° C. with exposure up to 28 days, and at 70° C. with exposure up to 12 days. When sufficient material was available, the stability was determined at both temperatures with readings for the maximum days stable and also the minimum days necessary to produce deterioration.

In table 3 are presented the detailed results of exposure at the two temperatures. The material, essentially the same as that referred to as current (1937) lots in the report on stability of neoarsphenamine, is classified according to moisture content and also to days of exposure to the artificial temperatures. The evidence of stability in this investigation is the same as that required in the previous study (*5*), i. e., the powder must be completely soluble and a 10 percent solution clear and transparent.

The records indicate that 28 days' exposure at 56° C. approximates the results obtained by 4 days at 70° C. The former showed approximately 70 percent unaffected as compared with 70.9 percent of the latter. The same relation is noted in the lots with moisture content of 0 to 1.5 percent—92 percent stable as compared with 89.8 percent at the higher temperature.

It is evident that the "heat test" at 70° C. offers a reliable and sensitive procedure for the determination of the stability of neoarsphenamine, and in a shorter time than the former official temperature requirement of 56° C. Deterioration at 70° C. for 48 hours approximates that observed after 3 years' storage at average room temperature (*5*).

That moisture is a contributing factor influencing the stability of neoarsphenamine, as previously recorded by Probey and Harrison (*5*), is confirmed in these observations. It is noted that under artificial heat instability increased directly with the moisture content, this increase being apparent at both temperatures and also at the various exposure times. The stability of neoarsphenamine is affected by the

TABLE 3.—*Stability of neoarsphenamine when exposed to artificial temperatures. Tested during 1937 (current material)*

Moisture content	Temperature 56° C.																		Temperature 70° C.											
	Days exposure																		Days exposure											
	1		2		4		8		12		16		20		24		28		1		2		4		6		8		10		12	
	S	U	S	U	S	U	S	U	S	U	S	U	S	U	S	U	S	U	S	U	S	U	S	U	S	U	S	U	S	U	S	U
Percent																																
0.0–0.5	25	0	25	0	25	0	25	0	25	0	25	0	13	0	13	0	10	2	25	0	24	1	23	2	19	6	17	8	11	14	7	18
0.5–1.0	122	0	122	0	122	0	122	0	122	2	115	4	82	4	61	5	53	5	90	0	90	0	83	7	73	16	55	31	43	41	26	58
1.0–1.5	95	1	95	1	95	1	91	3	91	3	91	3	77	3	59	4	52	4	90	1	90	1	79	12	55	36	25	65	14	76	6	85
1.5–2.0	53	0	53	0	53	0	53	0	53	0	51	2	45	4	19	18	16	18	45	1	38	8	24	22	14	32	0	46	0	46	0	46
2.0–2.5	38	0	38	0	38	2	36	4	30	10	24	15	16	15	4	15	4	15	28	0	19	15	8	26	4	31	1	31	1	31	0	32
2.5–3.0	18	0	18	0	13	4	9	8	5	12	2	15	1	15	0	15	0	15	2	8	1	10	0	11	0	11	0	11	0	11	0	11
3.0–3.5	6	0	6	0	5	1	2	3	2	3	0	5	0	5	0	5	0	5	4	6	0	9	0	9	0	9	0	9	0	9	0	9
0.0–1.5:																																
Number	242	1	242	1	242	1	238	5	230	5	231	7	172	7	130	9	120	11	235	1	224	2	185	21	147	58	98	104	68	131	39	161
Percent	99.5		99.5		99.5		98.8		97.9		97.0		95.9		93.5		92.0		99.5		99.0		89.8		71.7		47.7		34.3		19.5	
1.5–3.5:																																
Number	115	0	115	0	109	7	103	15	96	25	77	37	62	39	23	53	20	53	70	21	58	43	32	68	18	83	1	97	1	97	0	98
Percent	100		100		94.0		87.0		78.3		67.6		61.4		30.3		27.4		79.0		58.0		32.0		17.8		1.0		1.0		0	
Total number	357	1	357	1	351	8	338	18	326	30	308	44	234	46	153	62	140	64	234	22	282	45	217	89	165	141	96	201	69	228	39	259
Percent	99.7		99.7		97.8		94.9		91.6		87.5		83.6		71.1		69.8		92.8		85.3		70.9		53.9		32.3		23.2		13.1	

S=stable; U=unstable.

temperature, time of exposure, and the moisture content of the powder. Deterioration varies directly with these factors.

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DEATHS DURING WEEK ENDED JANUARY 21, 1939

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended Jan. 21, 1939	Corresponding week, 1938
Data from 88 large cities of the United States:		
Total deaths	8,924	[1] 8,990
Average for 3 prior years	[1] 9,547	
Total deaths, first 3 weeks of year	27,248	27,635
Deaths under 1 year of age	500	[1] 522
Average for 3 prior years	[1] 557	
Deaths under 1 year of age, first 3 weeks of year	1,611	1,634
Data from industrial insurance companies:		
Policies in force	68,391,428	69,764,818
Number of death claims	14,844	14,031
Death claims per 1,000 policies in force, annual rate	11.3	10.5
Death claims per 1,000 policies, first 3 weeks of year, annual rate	9.7	9.7

[1] Data for 86 cities.

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

CURRENT WEEKLY STATE REPORTS

These reports are preliminary, and the figures are subject to change when later returns are received by the State health officers.

In these and the following tables, a zero (0) indicates a positive report and has the same significance as any other figure, while leaders (----) represent no report, with the implication that cases or deaths may have occurred but were not reported to the State health officer.

Cases of certain diseases reported by telegraph by State health officers for the week ended January 28, 1939, rates per 100,000 population (annual basis), and comparison with corresponding week of 1938 and 5-year median

Division and State	Diphtheria				Influenza				Measles			
	Jan. 28, 1939, rate	Jan. 28, 1939, cases	Jan. 29, 1938, cases	1934–38, median	Jan. 28, 1939 rate	Jan. 28, 1939, cases	Jan. 29, 1938, cases	1934–38, median	Jan. 28, 1939, rate	Jan. 28, 1939, cases	Jan. 29, 1938, cases	1934–38, median
NEW ENG.												
Maine	60	10	0	2	60	10	2	7	48	8	143	143
New Hampshire	0	0	0	0	10	1	10	1	20	2	62	31
Vermont	0	0	0	0	----	----	----	----	228	17	264	35
Massachusetts	5	4	2	6	----	----	----	----	648	551	192	344
Rhode Island	0	0	0	0	----	----	----	1	53	7	----	31
Connecticut	6	2	2	2	12	4	6	40	1,505	507	10	87
MID. ATL.												
New York	11	28	33	50	[1] 107	[1] 155	[1] 14	[1] 21	486	1,214	564	629
New Jersey	15	13	12	14	23	19	12	30	30	25	1,011	139
Pennsylvania	27	53	37	48	----	----	----	----	71	140	5,953	1,667
E. NO. CEN.												
Ohio	28	37	41	41	----	----	----	8	16	21	1,574	263
Indiana	27	18	83	30	6	4	13	55	22	15	340	220
Illinois	30	46	41	41	20	30	35	56	20	31	5,915	214
Michigan [2]	8	8	18	18	2	2	1	4	451	427	971	52
Wisconsin	9	5	3	3	83	47	44	53	961	547	944	299
W. NO. CEN.												
Minnesota	14	7	3	5	4	2	4	3	2,437	1,257	9	104
Iowa	12	6	20	7	4	2	----	18	276	139	98	80
Missouri	33	26	19	31	42	33	145	214	10	8	933	441
North Dakota	29	4	3	5	44	6	3	11	2,169	297	18	18
South Dakota	38	5	3	3	15	2	----	----	2,983	397	----	14
Nebraska	0	0	0	8	4	1	4	4	122	32	1	56
Kansas	20	7	7	11	17	6	25	25	22	8	553	61

See footnotes at end of table.

Cases of certain diseases reported by telegraph by State health officers for the week ended January 28, 1939, rates per 100,000 population (annual basis), and comparison with corresponding week of 1938 and 5-year median—Continued

Division and State	Diphtheria				Influenza				Measles			
	Jan. 28, 1939, rate	Jan. 28, 1939, cases	Jan. 29, 1938, cases	1934–38, median	Jan. 28, 1939 rate	Jan. 28, 1939, cases	Jan. 29, 1938, cases	1934–38, median	Jan. 28, 1939, rate	Jan. 28, 1939, cases	Jan. 29, 1938, cases	1934–38, median
SO. ATL.												
Delaware	98	5	1	1							11	87
Maryland [3]	19	6	17	7	31	10	47	47	2,630	853	26	64
Dist. of Col.	24	3	9	9			3	5	178	22	12	23
Virginia [3]	43	23	12	26	1,156	617			253	135	398	398
West Virginia	46	17	10	19	110	41	38	63	30	11	286	27
North Carolina [3 4]	26	18	30	33	13	9	47	47	825	565	976	728
South Carolina [4]	41	15	5	5	1,773	649	711	744	14	5	159	44
Georgia [4]	13	8	16	16	183	110		193	65	39	310	
Florida	30	10	29	15	15	5	13	13	217	72	102	25
E. SO. CEN.												
Kentucky	19	11	5	14	47	27	46	46	83	48	473	68
Tennessee [4]	14	8	10	16	192	103	185	185	235	133	525	96
Alabama [4]	21	12	23	23	297	169	362	362	204	116	215	162
Mississippi [3 4]	20	8	5	8								
W. SO. CEN.												
Arkansas	20	8	13	10	345	139	190	94	79	32	196	18
Louisiana	85	35	10	19	19	8	22	20	462	191	3	41
Oklahoma	26	13	21	10	388	193	217	187	223	111	13	32
Texas [4]	48	58	73	73	582	703	719	697	62	75	60	154
MOUNTAIN												
Montana	28	3	0	2	468	50		57	3,791	405	6	11
Idaho	0	0	4	1	10	1	6	6	653	64	3	45
Wyoming	22	1	0	0					982	45	9	9
Colorado	116	24	10	8	217	45			231	48	174	14
New Mexico	25	2	4	4	124	10	1	3	358	29	157	61
Arizona	37	3	4	3	994	81	130	130	12	1	2	11
Utah [3]	0	0	6	0	89	9			367	37	54	54
PACIFIC												
Washington	3	1	4	0			4		348	113	21	94
Oregon	10	2	3	2	263	53	53	53	109	22	9	35
California [4]	23	28	31	32	27	33	144	144	1,660	2,025	174	239
Total	24	601	691	735	160	3,395	3,256	3,256	438	10,844	21,929	15,782
4 weeks	25	2,491	2,761	3,001	151	12,765	11,628	11,628	370	36,655	71,269	40,478

Division and State	Meningitis, meningococcus				Poliomyelitis				Scarlet fever			
	Jan. 28, 1939, rate	Jan. 28, 1939, cases	Jan. 29, 1938, cases	1934–38, median	Jan. 28, 1939, rate	Jan. 28, 1939, cases	Jan. 29, 1938, cases	1934–38, median	Jan. 28, 1939, rate	Jan. 28, 1939, cases	Jan. 29, 1938, cases	1934–38, median
NEW ENG.												
Maine	0	0	0	0	0	0	0	0	78	13	22	21
New Hampshire	0	0	0	0	0	0	0	0	81	8	13	13
Vermont	0	0	0	0	0	0	0	0	80	6	13	11
Massachusetts	2.4	2	0	0	0	0	0	1	228	194	286	265
Rhode Island	0	0	0	0	0	0	0	0	153	20	28	18
Connecticut	3	1	1	1	0	0	0	0	220	74	92	63
MID. ATL.												
New York	1.6	4	11	7	0	0	1	2	223	556	677	715
New Jersey	0	0	1	1	1.2	1	1	1	211	177	139	172
Pennsylvania	4	7	9	6	0	0	1	1	178	351	569	620

See footnotes at end of table.

Cases of certain diseases reported by telegraph by State health officers for the week ended January 28, 1939, rates per 100,000 population (annual basis), and comparison with corresponding week of 1938 and 5-year median—Continued

Division and State	Meningitis, meningococcus				Poliomyelitis				Scarlet fever			
	Jan. 28, 1939, rate	Jan. 28, 1939, cases	Jan. 29, 1938, cases	1934–38, median	Jan. 28, 1939, rate	Jan. 28, 1939, cases	Jan. 29, 1938, cases	1934–38, median	Jan. 28, 1939, rate	Jan. 28, 1939, cases	Jan. 29, 1938, cases	1934–38, median
E. NO. CEN.												
Ohio	0	0	3	9	0	0	0	1	380	495	486	461
Indiana	0	0	1	4	0	0	0	0	324	218	195	195
Illinois	2.6	4	5	7	0.7	1	3	1	343	524	837	584
Michigan [2]	2.1	2	1	2	0	0	0	0	604	571	560	463
Wisconsin	0	0	0	0	0	0	0	0	508	289	221	348
W. NO. CEN.												
Minnesota	1.9	1	0	1	0	0	1	1	328	169	178	147
Iowa	0	0	4	2	0	0	0	0	249	123	224	191
Missouri	2.6	2	2	2	0	0	1	0	166	120	231	210
North Dakota	7	1	0	1	0	0	0	0	153	21	28	36
South Dakota	0	0	0	0	0	0	0	0	158	21	13	44
Nebraska	0	0	1	1	0	0	0	0	104	43	47	57
Kansas	0	0	1	1	0	0	0	0	472	169	250	213
SO. ATL.												
Delaware	0	0	0	0	0	0	0	0	0	0	14	14
Maryland [2]	3	1	3	3	0	0	1	0	154	50	67	94
Dist. of Col	8	1	0	2	0	0	0	0	105	13	15	18
Virginia [3]	9	5	5	4	0	0	0	0	88	47	41	53
West Virginia	5	2	7	1	5	2	0	0	175	65	51	51
North Carolina [3 4]	2.9	2	5	3	2.9	2	1	1	85	58	62	50
South Carolina [4]	0	0	1	1	2.7	1	0	0	38	14	1	6
Georgia [4]	0	0	2	2	0	0	0	0	30	18	11	16
Florida	0	0	4	1	9	3	1	0	42	14	11	11
E. SO. CEN.												
Kentucky	9	5	10	8	1.7	1	2	0	123	71	85	67
Tennessee [4]	4	2	3	5	0	0	0	0	93	53	32	41
Alabama [4]	4	2	8	2	0	0	1	1	23	13	31	16
Mississippi [2 4]	2.5	1	2	0	0	0	1	0	30	12	4	11
W. SO. CEN.												
Arkansas	2.5	1	1	1	0	0	1	0	45	18	9	9
Louisiana	2.4	1	4	0	7	3	1	1	39	16	16	31
Oklahoma	0	0	2	2	0	0	0	0	109	54	49	48
Texas [4]	3	4	3	3	1.7	2	3	1	94	114	136	110
MOUNTAIN												
Montana	0	0	0	0	9	1	0	0	225	24	43	35
Idaho	0	0	1	0	0	0	0	0	92	9	29	29
Wyoming	0	0	0	0	0	0	0	0	240	11	14	12
Colorado	5	1	0	0	0	0	0	0	197	41	33	38
New Mexico	0	0	0	0	0	0	0	0	457	37	12	23
Arizona	12	1	0	0	0	0	0	0	25	2	11	20
Utah [3]	0	0	1	0	0	0	0	0	228	23	83	72
PACIFIC												
Washington	0	0	0	1	0	0	2	1	225	73	99	74
Oregon	0	0	1	1	0	0	0	0	348	70	70	70
California [4]	1.6	2	1	3	0	0	4	4	207	252	221	292
Total	2.2	55	104	104	0.7	17	26	26	213	5,343	6,359	6,359
4 weeks	2.1	212	377	474	0.7	67	85	94	205	20,581	23,787	23,892

See footnotes at end of table.

Cases of certain diseases reported by telegraph by State health officers for the week ended January 28, 1939, rates per 100,000 population (annual basis), and comparison with corresponding week of 1938 and 5-year median—Continued

Division and State	Smallpox				Typhoid and paratyphoid fever				Whooping cough		
	Jan. 28, 1939, rate	Jan. 28, 1939, cases	Jan. 29, 1938, cases	1934–38, median	Jan. 28, 1939, rate	Jan. 28, 1939, cases	Jan. 29, 1938, cases	1934–38, median	Jan. 28, 1939, rate	Jan. 28, 1939, cases	Jan. 29, 1938, cases
NEW ENG.											
Maine	0	0	0	0	6	1	5	0	109	18	55
New Hampshire	0	0	0	0	20	2	0	0	0	0	3
Vermont	0	0	0	0	0	0	0	0	1,059	79	31
Massachusetts	0	0	0	0	4	3	2	1	222	189	141
Rhode Island	0	0	0	0	0	0	0	0	458	60	59
Connecticut	0	0	0	0	0	0	0	0	424	143	39
MID. ATL.											
New York	0	0	0	0	2	6	7	5	261	653	462
New Jersey	0	0	0	0	0	0	0	3	502	422	187
Pennsylvania	0	0	0	0	5	10	6	6	224	441	284
E. NO. CEN.											
Ohio	15	19	8	3	5	7	2	1	204	265	149
Indiana	83	56	42	2	0	0	1	0	7	5	33
Illinois	7	10	84	17	2	3	2	7	255	389	112
Michigan [3]	2	2	4	0	1	1	1	3	242	229	195
Wisconsin	26	15	12	13	0	0	0	2	685	390	198
W. NO. CEN.											
Minnesota	33	17	35	5	8	4	0	1	101	52	53
Iowa	93	46	46	20	0	0	2	2	43	21	47
Missouri	13	10	48	17	3	2	8	2	30	23	49
North Dakota	73	10	23	7	0	0	0	0	7	1	80
South Dakota	68	9	3	4	0	0	0	0	23	3	23
Nebraska	11	3	2	2	15	4	0	1	0	0	8
Kansas	59	21	25	9	17	6	0	1	20	7	99
SO. ATL.											
Delaware	0	0	0	0	0	0	0	0	98	5	10
Maryland [3]	0	0	0	0	12	4	2	2	96	31	44
Dist. of Col	0	0	0	0	0	0	0	0	203	25	5
Virginia [3]	0	0	0	0	4	2	2	7	139	74	109
West Virginia	0	0	0	0	16	6	1	3	78	29	143
North Carolina [3 4]	0	0	1	1	6	4	6	5	441	302	419
South Carolina [4]	0	0	0	0	8	3	1	2	180	66	44
Georgia [4]	3	2	0	0	5	3	3	3	45	27	66
Florida	0	0	1	0	3	1	1	1	33	11	22
E. SO. CEN.											
Kentucky	5	3	34	0	0	0	2	3	28	16	49
Tennessee [4]	2	1	2	0	4	2	3	3	39	22	30
Alabama [4]	2	1	0	0	5	3	1	2	100	57	31
Mississippi [3 4]	3	1	4	0	3	1	2	1			
W. SO. CEN.											
Arkansas	2	1	12	2	5	2	3	3	32	13	41
Louisiana	0	0	0	0	51	21	4	4	2	1	6
Oklahoma	97	48	29	2	14	7	3	2	10	5	38
Texas [4]	24	29	30	2	9	11	13	11	106	128	136
MOUNTAIN											
Montana	37	4	7	7	19	2	0	1	131	14	24
Idaho	153	15	30	3	0	0	1	0	20	2	50
Wyoming	22	1	2	0	0	0	0	0	0	0	14
Colorado	39	8	4	2	5	1	0	0	356	74	12
New Mexico	62	5	0	0	12	1	3	3	321	26	36
Arizona	294	24	0	0	0	0	3	0	98	8	55
Utah [3]	0	0	1	0	10	1	0	0	248	25	46

See footnotes at end of table.

Cases of certain diseases reported by telegraph by State health officers for the week ended January 28, 1939, rates per 100,000 population (annual basis), and comparison with corresponding week of 1938 and 5-year median—Continued

Division and State	Smallpox				Typhoid and paratyphoid fever				Whooping cough		
	Jan. 28, 1939, rate	Jan. 28, 1939, cases	Jan. 29, 1938, cases	1934–38, median	Jan. 28, 1939, rate	Jan. 28, 1939, cases	Jan. 29, 1938, cases	1934–38, median	Jan. 28, 1939, rate	Jan. 28, 1939, cases	Jan. 29, 1938, cases
PACIFIC											
Washington	6	2	45	15	0	0	1	1	56	18	124
Oregon	75	15	11	5	0	0	0	0	75	15	28
California [4]	8	10	30	4	4	5	4	7	92	112	405
Total	15	388	575	185	5	129	95	101	182	4,496	4,294
4 weeks	15	1,548	2,409	864	5	458	464	493	176	17,459	15,918

[1] New York City only.
[2] Period ended earlier than Saturday.
[3] Rocky Mountain spotted fever, week ended Jan. 28, 1939, 2 cases as follows: Virginia, 1; North Carolina, 1.
[4] Typhus fever, week ended Jan. 28, 1939, 33 cases as follows: North Carolina, 4; South Carolina, 5; Georgia, 8; Tennessee, 3; Alabama, 5; Mississippi, 1; Texas, 5; California, 2.

SUMMARY OF MONTHLY REPORTS FROM STATES

The following summary of cases reported monthly by States is published weekly and covers only those States from which reports are received during the current week:

State	Meningitis, meningococcus	Diphtheria	Influenza	Malaria	Measles	Pellagra	Poliomyelitis	Scarlet fever	Smallpox	Typhoid and paratyphoid fever
October 1938										
Puerto Rico	3	46	182	3,322	2	1	0	0	0	24
November 1938										
Wisconsin	1	----	----	----	439	----	1	----	27	6
December 1938										
Hawaii Territory	0	13	233	----	3	----	0	0	0	3
Illinois	2	192	69	8	112	----	4	1,566	15	26
Massachusetts	5	23	----	3	902	1	0	506	0	9
Montana	0	5	61	----	1,002	----	0	101	17	4
Nevada	0	0	5	----	60	----	0	9	0	0
North Dakota	1	14	70	----	1,309	----	1	89	10	3
Ohio	8	206	80	2	89	1	2	1,630	25	23
Oklahoma	2	98	515	41	131	12	2	249	74	24
Oregon	0	6	104	1	----	----	2	237	30	3
South Carolina	0	110	1,749	415	28	76	10	55	0	10
Washington	2	16	11	----	730	----	2	269	11	3

October 1938

Puerto Rico:	Cases
Chickenpox	5
Dysentery	4
Leprosy	2
Mumps	2
Ophthalmia neonatorum	5
Puerperal septicemia	2
Tetanus	6
Whooping cough	156

November 1938

Wisconsin:	
Chickenpox	1,890
Mumps	217
Septic sore throat	3
Tularaemia	5
Undulant fever	3
Whooping cough	1,719

December 1938

Anthrax:	
Oklahoma	1
Chickenpox:	
Hawaii Territory	101
Illinois	1,778
Massachusetts	1,006
Montana	199
Nevada	25
North Dakota	110
Ohio	2,649
Oklahoma	120
Oregon	311
South Carolina	58
Washington	885
Conjunctivitis, epidemic:	
Hawaii Territory	1
Diarrhea:	
Ohio (under 2 years; enteritis included)	20
South Carolina	245
Dysentery:	
Hawaii Territory	2
Illinois (amoebic)	6
Illinois (amoebic carriers)	23
Illinois (bacillary)	19
Massachusetts (bacillary)	14
Montana (amoebic)	1
Ohio	28
Oklahoma (bacillary)	8
Washington (bacillary)	3
Encephalitis, epidemic or lethargic:	
Illinois	5
Massachusetts	7
Montana	2
North Dakota	1

December 1938—Continued

Encephalitis, epidemic or lethargic—Continued.	Cases
Ohio	3
Oregon	1
South Carolina	1
German measles:	
Illinois	29
Massachusetts	55
Montana	21
North Dakota	39
Ohio	15
South Carolina	8
Washington	13
Hookworm disease:	
Hawaii Territory	7
South Carolina	64
Impetigo contagiosa:	
Hawaii Territory	12
Montana	23
Oklahoma	3
Oregon	53
Jaundice, infectious:	
Oregon	1
Lead poisoning:	
Ohio	3
Leprosy:	
Hawaii Territory	2
Ohio	1
Mumps:	
Hawaii Territory	55
Illinois	275
Massachusetts	470
Montana	9
Nevada	93
North Dakota	9
Ohio	938
Oklahoma	14
Oregon	69
South Carolina	78
Washington	217
Ophthalmia neonatorum:	
Illinois	3
Massachusetts	23
Ohio	81
South Carolina	3
Puerperal septicemia:	
Ohio	3
Washington	1
Rabies in animals:	
Illinois	28
Massachusetts	1
Oregon	2
South Carolina	37
Washington	47
Rabies in man:	
Washington	1
Scabies:	
Oklahoma	24
Oregon	84

December 1938—Continued

Septic sore throat:	Cases
Illinois	9
Massachusetts	13
Montana	26
North Dakota	1
Ohio	86
Oklahoma	67
Oregon	14
South Carolina	3
Washington	5
Tetanus:[1]	
Hawaii Territory	1
Illinois	2
South Carolina	1
Trachoma:	
Hawaii Territory	11
Illinois	38
Montana	17
North Dakota	5
Oklahoma	6
Trichinosis:	
Massachusetts	3
Tularaemia:	
Illinois	350
Ohio	130
Oklahoma	27
South Carolina	3
Typhus fever:	
Hawaii Territory	8
Ohio	1
South Carolina	14
Undulant fever:	
Illinois	20
Massachusetts	5
Nevada	2
North Dakota	1
Ohio	9
Oklahoma	107
South Carolina	1
Washington	1
Vincent's infection:	
Illinois	26
North Dakota	8
Oklahoma	23
Oregon	12
Washington	1
Whooping cough:	
Hawaii Territory	41
Illinois	1,954
Massachusetts	784
Montana	109
Nevada	20
North Dakota	36
Ohio	708
Oklahoma	35
Oregon	76
South Carolina	157
Washington	85

[1] Later information shows only 9 cases of tetanus in Michigan in December 1938, instead of 22 as published in the Public Health Reports of Feb. 3, 1939, p. 197.

WEEKLY REPORTS FROM CITIES

City reports for week ended Jan. 21, 1939

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Data for 90 cities:											
5-year average	210	1,320	160	3,025	1,056	1,805	32	386	20	1,186	----
Current week [1]	166	312	71	3,051	702	1,543	68	338	25	1,513	----
Maine:											
Portland	0	----	0	0	4	0	0	0	0	5	21
New Hampshire:											
Concord	0	----	0	0	1	1	0	1	0	0	10
Manchester	0	----	0	0	4	7	0	1	0	0	22
Nashua	0	----	0	0	0	0	0	0	0	0	8
Vermont:											
Barre	0	----	0	0	1	1	0	0	0	1	4
Burlington	0	----	0	0	0	1	0	0	1	4	9
Rutland	0	----	0	0	1	0	0	0	0	0	6
Massachusetts:											
Boston	0	----	2	172	24	61	0	14	1	57	212
Fall River	----	----	----	----	----	----	----	----	----	----	----
Springfield	0	----	0	12	1	3	0	2	0	5	34
Worcester	0	----	0	0	7	9	0	1	0	19	54
Rhode Island:											
Pawtucket	0	----	0	0	0	0	0	0	0	0	21
Providence	0	3	0	11	4	12	0	1	0	56	53
Connecticut:											
Bridgeport	0	1	1	2	2	2	0	1	0	13	32
Hartford	0	----	0	111	4	8	0	2	0	11	32
New Haven	1	----	0	10	2	4	0	0	0	9	40
New York:											
Buffalo	1	----	0	104	15	58	0	9	1	22	148
New York	34	87	6	58	146	173	0	88	3	169	1,680
Rochester	1	1	0	45	8	27	0	1	0	13	76
Syracuse	0	----	0	11	6	9	0	0	1	30	68
New Jersey:											
Camden	1	1	1	0	3	4	0	1	0	8	37
Newark	1	----	0	6	7	24	0	3	0	54	102
Trenton	0	2	0	0	4	2	0	2	0	7	35
Pennsylvania:											
Philadelphia	6	9	4	12	31	52	0	17	1	145	463
Pittsburgh	3	4	3	0	13	49	0	7	2	41	166
Reading	7	----	0	1	1	2	0	0	0	0	20
Scranton	0	----	----	0	----	12	0	----	0	9	----
Ohio:											
Cincinnati	7	2	1	0	16	17	0	5	0	1	145
Cleveland	2	19	1	3	21	62	0	14	0	49	213
Columbus	0	----	0	2	8	7	0	1	0	2	113
Toledo	0	2	2	2	5	33	0	4	0	26	86
Indiana:											
Anderson	0	----	0	0	1	3	0	0	0	5	16
Fort Wayne	1	----	0	0	3	3	0	1	0	0	37
Indianapolis	3	----	2	3	19	49	31	2	1	1	105
Muncie	0	----	1	1	0	1	2	0	0	0	13
South Bend	0	----	1	0	2	4	1	0	0	0	17
Terre Haute	0	----	0	0	2	4	1	1	0	0	----
Illinois:											
Alton	0	----	0	0	2	3	0	0	0	1	9
Chicago	25	7	1	14	41	199	1	24	0	288	688
Elgin	0	----	0	0	4	11	0	0	0	0	11
Moline	0	----	0	0	0	2	0	0	0	0	12
Springfield	1	----	0	0	3	2	0	1	0	0	24
Michigan:											
Detroit	7	2	2	23	19	130	0	15	1	125	303
Flint	0	----	0	199	7	36	0	0	0	1	29
Grand Rapids	0	----	2	4	4	31	0	0	0	3	32
Wisconsin:											
Kenosha	0	----	0	0	0	5	0	0	0	24	3
Madison	2	----	0	2	1	3	0	0	0	11	20
Milwaukee	0	3	3	2	9	112	0	3	0	115	95
Racine	0	----	0	1	0	6	0	3	0	2	15
Superior	0	----	0	1	0	2	0	0	0	0	5

[1] Figures for Fall River and Salt Lake City estimated; reports not received.

City reports for week ended Jan. 21, 1939—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Minnesota:											
Duluth	0	----	0	1	2	3	0	1	0	11	20
Minneapolis	1	----	1	133	10	34	1	0	0	35	112
St. Paul	0	1	1	441	4	18	0	5	0	13	62
Iowa:											
Cedar Rapids	0	----	----	0	----	0	0	----	0	0	----
Davenport	1	----	----	0	----	5	2	----	0	0	----
Des Moines	1	----	0	0	0	24	0	0	1	0	35
Sioux City	1	----	----	17	----	5	0	----	0	6	----
Waterloo	1	----	----	0	----	11	0	----	0	0	----
Missouri:											
Kansas City	0	----	1	5	8	50	2	2	0	2	88
St. Joseph	0	----	0	0	4	2	0	0	0	0	23
St. Louis	6	----	1	2	12	39	4	8	0	8	197
North Dakota:											
Fargo	0	----	0	0	0	2	0	0	0	0	6
Grand Forks	0	----	----	2	----	0	0	----	0	0	----
Minot	2	----	0	26	0	0	0	0	0	0	4
South Dakota:											
Aberdeen	0	----	----	7	----	1	6	----	0	0	----
Nebraska:											
Omaha	0	----	0	4	8	1	0	0	0	0	57
Kansas:											
Lawrence	0	2	0	1	1	0	0	0	0	0	6
Topeka	0	----	0	0	0	5	0	0	0	2	15
Wichita	3	----	0	1	1	3	0	0	0	0	30
Delaware:											
Wilmington	3	----	0	0	3	4	0	1	0	1	28
Maryland:											
Baltimore	1	10	0	613	25	21	0	12	1	27	244
Cumberland	0	----	0	0	1	0	0	1	1	5	13
Frederick	1	----	0	0	0	5	0	0	0	0	4
Dist. of Col.:											
Washington	3	6	1	5	3	13	0	4	1	32	149
Virginia:											
Lynchburg	0	----	0	3	2	0	0	0	0	8	11
Norfolk	8	1	0	1	7	2	0	1	0	1	42
Richmond	1	----	3	1	4	0	0	2	2	0	55
Roanoke	0	----	0	0	0	0	0	2	0	0	17
West Virginia:											
Charleston	4	1	1	0	3	1	0	0	0	0	21
Huntington	0	----	----	0	----	0	0	----	0	0	----
Wheeling	1	----	0	2	6	1	0	0	1	2	30
North Carolina:											
Gastonia	0	----	0	0	0	1	0	1	0	0	----
Raleigh	0	----	0	0	2	1	0	1	0	1	17
Wilmington	1	----	0	0	1	0	0	0	0	7	6
Winston-Salem	0	----	0	36	0	1	0	1	0	0	9
South Carolina:											
Charleston	0	76	4	0	4	2	0	1	1	0	35
Florence	0	----	0	0	0	0	0	0	0	2	8
Greenville	1	----	0	0	1	0	0	0	0	2	5
Georgia:											
Atlanta	0	19	5	2	6	6	0	3	0	1	78
Brunswick	0	----	0	2	0	0	0	0	0	1	1
Savannah	0	23	1	0	2	3	0	2	0	3	21
Florida:											
Miami	2	----	0	0	1	2	0	0	0	1	36
Tampa	3	2	2	9	1	0	0	1	0	2	23
Kentucky:											
Ashland	1	----	0	0	1	1	0	0	0	0	4
Covington	0	----	0	0	4	16	0	0	0	0	17
Louisville	1	1	1	3	8	15	0	1	0	1	69
Tennessee:											
Knoxville	2	6	1	0	1	0	0	1	0	0	23
Memphis	0	----	2	0	4	4	0	5	0	2	78
Nashville	0	----	1	0	6	6	0	0	0	0	57
Alabama:											
Birmingham	0	5	2	1	10	1	0	4	0	0	84
Mobile	0	2	2	1	5	3	0	0	0	0	25
Montgomery	0	----	----	0	----	0	0	----	0	0	----

City reports for week ended Jan. 21, 1939—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths all causes
		Cases	Deaths								
Arkansas:											
Fort Smith	0	5	----	1	----	0	0	----	0	0	----
Little Rock	0	----	0	0	4	7	0	0	0	0	5
Louisiana:											
Lake Charles	0	----	0	12	0	1	0	0	0	0	5
New Orleans	9	4	3	21	14	11	0	9	3	2	177
Shreveport	1	----	1	6	6	0	0	0	2	0	24
Oklahoma:											
Oklahoma City	0	----	0	0	7	7	0	1	0	0	45
Tulsa	1	----	0	4	0	3	0	0	0	0	1
Texas:											
Dallas	0	2	2	1	7	10	9	3	0	0	73
Fort Worth	0	23	1	0	3	8	0	1	0	1	36
Galveston	0	----	0	0	5	1	0	0	0	0	15
Houston	4	----	1	0	6	3	1	4	0	0	73
San Antonio	1	----	2	0	8	0	0	8	0	0	65
Montana:											
Billings	0	----	0	128	2	2	0	0	0	0	11
Great Falls	0	----	0	0	1	1	1	0	0	1	5
Helena	0	----	0	4	0	0	0	0	0	0	2
Missoula	0	----	0	2	0	3	2	0	0	0	5
Idaho:											
Boise	0	----	0	1	4	0	0	0	0	2	8
Colorado:											
Colorado Springs	0	----	0	2	0	4	0	3	0	6	9
Denver	4	----	1	6	9	10	0	5	0	27	77
Pueblo	0	----	0	0	3	4	1	0	0	0	8
New Mexico:											
Albuquerque	0	----	0	0	2	3	0	2	1	3	16
Utah:											
Salt Lake City	----	----	----	----	----	----	----	----	----	----	----
Washington:											
Seattle	0	----	0	2	6	8	0	2	0	1	96
Spokane	0	----	0	11	1	1	0	0	0	0	32
Tacoma	0	----	0	6	2	5	0	1	0	1	30
Oregon:											
Portland	0	----	0	1	5	8	1	0	0	0	75
Salem	0	1	----	0	----	4	2	----	0	0	----
California:											
Los Angeles	18	18	2	45	28	55	1	16	2	26	426
Sacramento	0	----	0	12	1	3	12	2	0	0	34
San Francisco	0	2	1	736	13	14	0	7	0	9	200

State and city	Meningitis, meningococcus		Poliomyelitis cases
	Cases	Deaths	
New York:			
Buffalo	1	0	0
New York	2	3	0
Pennsylvania:			
Philadelphia	2	0	0
Illinois:			
Chicago	1	0	1
North Carolina:			
Wilmington	1	0	0
South Carolina:			
Charleston	0	0	1
Louisiana:			
Shreveport	0	1	0
Texas:			
Houston	1	0	1

Encephalitis, epidemic or lethargic.—Cases: Albuquerque, 1.
Pellagra.—Cases: Toledo, 1; Wilmington, N. C., 1; Charleston, S. C., 2; Savannah, 3; Fort Smith, 1; San Francisco, 1.
Rabies in man.—Deaths: Detroit, 1.
Typhus fever.—Cases: Charleston, S. C., 6; San Antonio, 1; Los Angeles, 2.

FOREIGN AND INSULAR

CANADA

Provinces—Communicable diseases—2 weeks ended January 14, 1939.—During the 2 weeks ended January 14, 1939, cases of certain communicable diseases were reported by the Department of Pensions and National Health of Canada as follows:

Disease	Prince Edward Island	Nova Scotia [1]	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis			2	1	2	1				6
Chickenpox		7	5	406	942	47	77	48	322	1,854
Diphtheria		11	5	95	11	14	8	1		145
Dysentery					1					1
Erysipelas				13	10	4	1	3	2	33
Influenza		12			29	5			13	59
Measles		13		466	1,555	69	14	12	52	2,181
Mumps					148	81	1	13	5	248
Paratyphoid fever					3				1	4
Pneumonia		2			64			2	27	95
Poliomyelitis		1		1		2		1		5
Scarlet fever		19	20	140	387	53	53	66	32	770
Smallpox						6	9			15
Trachoma						1				1
Tuberculosis	1	40	9	73	128	3		3	22	279
Typhoid fever			5	24	1	3	1	1	2	37
Undulant fever					3				3	6
Whooping cough		3	4	263	642	116	14	6	64	1,112

[1] For 2 weeks ended Jan. 18, 1939.

CUBA

Habana—Communicable diseases—4 weeks ended January 14, 1939.—During the 4 weeks ended January 14, 1939, certain communicable diseases were reported in Habana, Cuba, as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Diphtheria	11	1	Tuberculosis	13	7
Malaria	23	1	Typhoid fever	65	8

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER

NOTE.—A table giving current information of the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS for January 27, 1939, pages 137–148. A similar cumulative table will appear in future issues of the PUBLIC HEALTH REPORTS for the last Friday of each month.

Plague

Brazil.—During the month of October 1938, 1 case of plague was reported in Alagoas State, and 20 cases of plague with 10 deaths were reported in Pernambuco State, Brazil.

Peru.—During the month of November 1938, plague was reported in Peru as follows: Cajamarca Department, 1 case, 1 death; Libertad Department, 3 cases, 1 death; Lima Department, 2 cases, 2 deaths.

Smallpox

Mexico.—During the month of November 1938, smallpox was reported in Mexico as follows: Mexico, D. F., 2 cases; Pachuca, Hidalgo State, 7 cases; San Luis Potosi, San Luis Potosi State, 7 cases; Tampico, Tamaulipas State, 1 case.

Typhus Fever

Mexico.—During the month of November 1938, typhus fever was reported in Mexico as follows: Mexico, D. F., 13 cases, 4 deaths; Oaxaca, Oaxaca State, 3 cases; Pachuca, Hidalgo State, 1 case; Puebla, Puebla State, 3 cases, 1 death; Queretaro, Queretaro State, 2 cases; San Luis Potosi, San Luis Potosi State, 1 case; Tepic, Nayarit State, 1 case; Toluca, Mexico State, 7 cases.

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